Chapter 5 - Environmental Consequences

Chapter 5 – Klamath River - California Segment

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This chapter is organized by resource or topic and the narrative presents the potential impacts to that resource or topic from all the different proposed actions of the alternatives. Only those actions that would have potential impacts are discussed for the various resources or topics. Each resource or topic has the potential cumulative impacts summarized for each alternative.

Scenic Quality

Assumptions

All BLM managed lands within the planning area are classified and managed as BLM Visual Resource Management (VRM) Class II. VRM Class II lands are to be managed for low levels of change to the characteristic landscape. Management activities may be seen but should not attract the attention of the casual observer. Any modifications should repeat the basic elements of form, line, texture, color, and scale found in the predominant natural features of the characteristic landscape. All BLM management activities that have the potential to affect the scenic quality in the planning area would be evaluated using the VRM process, prior to implementation, and necessary design modification and/or mitigation would be used to maintain or enhance the scenic quality.

The Oregon State Scenic Waterways Program will enforce administrative rules for the Oregon State Scenic Waterway portion of the planning area. State Scenic Waterways and county zoning regulations will continue subject to compliance with federal designation as stipulated under Goal 5 of state land use law. These regulations would govern the use and development of private lands for activities such as timber harvesting and house building.

Future developments occurring on private lands outside the scope of this plan (private lands other than PacifiCorp) within the view shed of the planning area could potentially have significant negative impacts on scenic quality. Projects on private lands, such as timber clearcuts, construction of communications towers, water towers, buildings, pipelines, powerlines and roads, could cause severe negative impacts to the scenic Outstandingly Remarkable Value of the WSR designation.

Proposed vegetation treatments were analyzed, by alternative, using GIS modeling to determine areas of high visibility along the Klamath River (20 miles) and 17 key observation points. The observation points were selected using areas such as common viewing areas and popular recreation sites (Spring Island boat launch, Klamath River Campground).

Impacts Common to All Alternatives

Management activities related to cultural resources protection are expected to have little if any impact to scenic quality under all alternatives. Road closures and signing to protect cultural resources would be designed to have a neutral or beneficial effect to scenic quality. Activities such as environmental education, interpretive displays, historic building stabilization or reconstruction would also have little potential to negatively impact scenic quality.

Management activities related to watershed values are expected to have essentially the same impacts to scenic quality under all alternatives. More consistent flow rates in all segments would lessen the visual impact of the daily “inundation/exposure” of the stream channel caused by the peaking operation of the J.C. Boyle hydroelectric plant. This “inundation/exposure” effect causes large areas of wet, slimy rocks in the streambed, and an unnatural

appearing dry channel. The impact of improved water quality has the slight potential to improve scenic quality of the flowing river by lessening the amount of foam seen in eddies, and by causing the water to appear clearer and brighter, particularly in whitewater rapids.

Livestock Grazing/Range Management activities would have no or very minor impacts to scenic quality under all alternatives. Grazing would be most visible in Segment 3 on PacifiCorp lands. Because there are currently many rustic appearing cultural modifications in this segment related to ranching such as buildings, hay fields, and rock walls, continued grazing at low to moderate levels is not expected to cause significant negative impacts to scenic quality.

Scenic quality would be positively impacted by terrestrial species habitat management actions under the assumption that improved diversity of species and population numbers of wildlife would improve wildlife viewing opportunities, a positive aesthetic feature of scenic quality. The impacts of vegetation treatments designed to improve wildlife habitat are discussed in the Vegetation and Biological Diversity section.

Impacts to scenic quality from prescribed fires would be common to all alternatives. There would be short-term negative impacts to scenic quality caused by smoke, dust, and ground disturbance from heavy equipment and firebreak construction during project implementation. Areas would appear blackened from the prescribed fire activities. Prescribed fires and small scale, low intensity wildfires would have short-term negative affects but help achieve the long-term benefits for scenery management by improving forest health and reducing the risk of catastrophic wildfires. A large-scale catastrophic wildfire would have severe impacts to the scenic quality by burning down vegetative communities that would require 50-150 years to return.

Structures and facilities of the J.C. Boyle hydroelectric project, such as the canals, spillways, forebay, power lines, and the powerhouse, create strong visual contrast and negative impacts on the scenic resources found in the planning area. This plan does not propose any changes to PacifiCorp hydroelectric facilities. While these impacts to scenic resources are outside the scope of this plan, it should be noted that the impacts of hydroelectric facilities on scenic resources would be addressed during the FERC relicensing process.

Impacts of Specific Alternatives

(Refer to Maps 5, 13-16, 17a-20a, 21-24, 25-28 and Appendix H)

Alternative 1

Scenery Management - See “Impacts Common to All Alternatives”.

Recreation - Management of existing recreation facilities and trails and the development of new facilities is guided by the VRM class II guidelines to protect scenic quality. Scenic quality continues to be impacted by the uncontrolled use of OHVs creating new roads and trails, and traveling cross-country in open areas. Vehicles are encountered at the river in many areas near the Frain Ranch (see Map 13).

Road Management - The extensive network of roads throughout the Frain Ranch area (PacifiCorp lands) would continue to impact scenic quality by soil disturbance, removal of vegetation, and unnatural appearing road alignment (see Map 17a).

Vegetation Management - Alternative 1 proposes limited vegetative treatments, compared to the other alternatives (see Map 21). Prescribed fire and thinning treatment designed to increase vegetative and biological diversity would, in some cases, have short-term negative effects on recreation users. While mitigation measures and treatments would be designed to

minimize negative effects, some short-term negative affects would at times be visible. Such effects would include small piles of brush and small trees, small tree and brush stumps cut close to ground, and some ground disturbance from mechanized equipment. Other effects would include some localized noise from saws and machinery, dust and smoke from controlled fire and other common affects from forest industrial operations during project implementation.

In many cases, vegetation treatments would enhance scenic quality by increasing scenic and wildlife diversity. Some of these treatments would enhance existing scenery, by targeting areas near recreation sites or along roads that lack vegetative diversity. Treatments would be designed to enhance areas where existing vegetation such as large old growth trees or geologic features are hidden due to overstocked stands, heavy fuel loads, or decadent, old brush.

Aquatic Species/Habitat Management - Management activities would be minimal and mainly in response to requirements of the Endangered Species Act. Few negative impacts or long-term benefits to scenic quality would be anticipated under this alternative (see Map 25).

Cumulative Impacts - Management actions from construction, forest thinning, and prescribed burning would likely have short-term negative impacts to scenic quality. However, over the long-term, vegetative regrowth, replacement of noxious weeds with native species, and controls on human uses, would contribute to improved scenic quality.

Alternative 2

Scenery Management - See “Impacts Common to All Alternatives”

Recreation - The construction of developed day use sites, campgrounds, and trailheads could cause some impact to scenic quality by creating unnatural, disharmonious appearing openings, colors, lines, or shapes, in the landscape. The Shovel Creek campground proposed in Segment 3 at the Beswick site would be sited in an existing hay field. The construction phase would create numerous short-term impacts from exposed earth, piles of building materials, new access roads, holes dug to place toilets, and other construction elements. By placing the campground in a meadow, it would require more landscaping and more time for the landscaping to mature, to lessen the visual impact (see Map 14).

The construction of non-motorized trails could cause minor short-term negative impacts to scenic quality by creating a strong line with contrasting color, from the ground disturbance where the trails traverse large openings that are readily viewed from common viewing areas. This visual contrast would be apparent until vegetation is re-established. The construction of a bridge for non-motorized travel, located at the upper end of Frain Ranch, would impact scenic quality by introducing cultural modification to an otherwise natural appearing landscape. The bridge would also have the effect of drawing more attention to nearby roads that currently are mostly hidden in the background of the river view.

The management of campfires and related fire risk behavior by regulated use seasons and camping areas would help to lessen the risk of catastrophic wildfire, and the attendant extreme impacts to scenic quality.

The construction of interpretive displays, brochures, environmental education efforts, could have an indirect beneficial impact on scenic quality by fostering a greater appreciation and stewardship ethic amongst visitors to the planning area. This type of visitor would be more likely to take an active role in helping to maintain and improve scenic quality by volunteering to help with vegetation treatments or clean up projects, and by noting and reporting illegal activities that might jeopardize scenic quality.

Creating designated OHV travel routes and restricting motorized travel to designated roads would have the beneficial impact of lessening the amount of visual damage to meadows caused by unrestricted, cross country OHV use.

Road Management - The closure and obliteration of 9.0 miles of roads, would enhance scenic quality by lessening the spider webbed appearance of the large flat areas around the Frain Ranch (PacifiCorp lands). The construction of new access roads to reach dispersed camp areas could impact scenic quality by increasing contrast in line and color (see Map 18a).

Vegetation Management - The types of vegetation treatments proposed include fenced exclosures of meadows, thinnings of various forest types with chain saws, shearers, and other mechanized equipment, and clearing brush fields with mowers. Impacts to scenic quality common to all of these treatments would include changing the pattern, lines, and colors of the vegetation, visible stumps and piles of slash left behind, and ground disturbance created by mechanized equipment. Short-term impacts to scenic quality would be created by smoke and dust and the presence of heavy equipment during operations (see Map 22).

A very small percentage (estimated less than 10 %) of the surface area of the proposed vegetation treatment units would be highly visible from key observation points such as scenic overlook areas and popular recreation sites. These highly visible areas are found near the top of steep slopes adjacent to the observation points.

In many cases, vegetation treatments would enhance scenic quality. Some of these treatments would enhance existing scenery, by targeting areas near recreation sites or along roads that lack vegetative diversity. Treatments would be designed to enhance areas where existing vegetation such as large old growth trees or geologic features are hidden due to overstocked stands or decadent, old brush. For example, additional scenic vistas may be able to be created through careful vegetation manipulation along Topsy Road and elsewhere. Targeted vegetative plantings would be used to improve scenic quality where vegetation is lacking, or to screen culturally modified areas from view.

Aquatic Species/Habitat Management - Management activities such as channel improvement/restoration, placement of large woody debris, and reconstruction of irrigation diversions, all have the potential to create short-term negative impacts to scenic quality. The presence of heavy equipment in the river, piles of materials stockpiled in central areas, and heavy helicopter traffic, could cause enough temporary degradation to scenic quality to prompt negative perceptions of management actions and generate complaints to BLM, PacifiCorp, and other managing entities (see Map 26).

Cumulative Impacts - The project implementation work associated with all the proposed actions would have short-term impact to scenic quality. However, once projects are completed, impacts to scenic quality are expected to be either neutral or beneficial. Construction of a new, non-motorized access bridge and other new recreation developments would introduce new cultural modifications into a landscape that is relatively undeveloped.

Alternative 3

Scenery Management - See “Impacts Common to All Alternatives”.

Recreation Facilities and Management - Alternative 3 proposes the least amount of facility development and an extensive amount of road closure, recreation site closure, and riparian site restoration work. The impacts of this alternative to scenic quality would be to create a more natural appearing landscape, with the least amount of development and cultural modification. All of this would result in a long-term improvement to scenic quality (see Map 15).

The construction of non-motorized trails would cause minor short-term negative impacts to scenic quality by creating a strong line with contrasting color, from the ground disturbance where the trails traverse large openings that are readily viewed from common viewing areas.

Creating designated OHV travel routes and restricting motorized travel to designated roads would have the beneficial impact of lessening the amount of visual damage to meadows caused by unrestricted, cross country OHV use.

The management of campfires and related fire risk behavior by regulated use seasons and camping areas would help to lessen the risk of catastrophic wildfire, and the attendant extreme impacts to scenic quality.

Road Management - Alternative 3 would receive the most extensive road closures and road restoration efforts of all alternatives (see Map 19a). The closure and obliteration of duplicate roads, would enhance scenic quality by lessening the spider web appearance of the large flat areas around the Frain ranch (PacifiCorp lands) and giving other areas a more natural appearance. Road treatments designed to keep OHV vehicles on the roads and from creating braided roads and roads in meadows, would have the long-term benefit of maintaining the meadows and openings in a more natural appearance.

Vegetation Management - This alternative, with the greatest amount of vegetation treatments would have the greatest opportunity for short-term negative impacts to scenic quality. While mitigation measures and treatments would be designed to avoid long-term negative impacts to scenic quality, some short-term negative impacts would occur. Such visual impacts would include small piles of brush and trees, tree and brush stumps cut close to ground, dust and smoke, scars from ground disturbance, and mechanized equipment working in an otherwise primitive, natural appearing landscape (see Map 23).

A very small percentage (estimated less than 10 %) of the surface area of the proposed vegetation treatment units would be highly visible from key observation points such as scenic overlook areas and popular recreation sites. These highly visible areas are found near the top of steep slopes adjacent to the observation points.

In many cases, vegetation treatments would enhance scenic quality. Some of these treatments would enhance existing scenery, by targeting areas near recreation sites or along roads that lack vegetative diversity. Treatments would be designed to enhance areas where existing vegetation such as large old growth trees or geologic features are hidden due to overstocked stands, heavy fuel loads, or decadent, old brush. For example, additional scenic vistas may be created through careful vegetation manipulation along Topsy Road and elsewhere. Many treatments are proposed to improve wildlife habitat. This would have the indirect benefit of increasing wildlife species diversity and population numbers. Targeted vegetative plantings would be used to improve scenic quality where vegetation is lacking, or to screen culturally modified areas from view.

Aquatic Species/Habitat Management - Management activities such as channel improvement/restoration, placement of large woody debris, and reconstruction of irrigation diversions, all have the potential to create short-term negative impacts to scenic quality. The presence of heavy equipment in the river, piles of materials stockpiled in central areas, and heavy helicopter traffic, could cause enough degradation to scenic quality to prompt negative perceptions of management actions and generate complaints to BLM, PacifiCorp, and other managing entities (see Map 27).

Enhancing fish habitat and passage through riparian/vegetation treatments, structural changes and channelization efforts would have the long-term effect of no impact or a slight improvement to scenic quality. Providing for fish passage and modifying fish ladders would enhance the opportunity to view anadromous and resident fish, which would benefit scenic quality.

Cumulative Impacts - The project implementation work associated with all proposed actions would have short-term impacts to scenic quality. In many cases this impact would only occur during the project implementation. In some cases visual contrast may persist for 1-5 years until vegetation is reestablished. However, once projects are completed, impacts to scenic quality are expected to be either neutral or beneficial. Management of recreation facilities and use would result in fewer cultural modifications and less visual contrast, which would result in little to no negative impact to scenic quality.

Alternative 4

Scenery Management - PacifiCorp structures and facilities of the J.C. Boyle hydroelectric project, such as water canals, emergency spillway, forebay, penstocks, transmission lines, substation, and power station, would have negative impacts to scenic quality. This impact will also be addressed during the FERC relicensing process of the Klamath hydroelectric project.

Recreation Facilities and Management - Alternative 4 provides the greatest amount of developed camping, day use, interpretive facilities and hiking trails of all the proposed alternatives. This alternative also provides the greatest amount of Off-highway vehicle opportunities and maintained roads. OHV tour routes would be designated, signed and improved, with informational brochures to provide scenic tour opportunities for users. New bridges would greatly expand motorized loop trail opportunities (see Map 16). New tour routes would be provided, primarily in California (PacifiCorp lands).

The construction of developed day use sites, campgrounds, and trailheads would cause some impact to scenic quality by creating unnatural, disharmonious appearing openings, colors, lines, or shapes, in the landscape. The campground proposed in segment 3 at the Beswick site, would be sited in an existing hay field. The construction phase would create numerous short-term impacts from exposed earth, piles of building materials, new access roads, holes dug to place toilets, and other construction elements. By placing the campground in a meadow, it would require more landscaping and more time for the landscaping to mature, to lessen the visual impact.

The construction of non-motorized trails would cause minor short-term negative impacts to scenic quality by creating a strong line with contrasting color, from the ground disturbance where the trails traverse large openings that are readily viewed from common viewing areas. The negative impacts caused by non-motorized trail would have its greatest negative impacts to scenic quality in this alternative when compared to the other alternatives.

Having fewer restrictions on use levels of commercial whitewater rafting could have the impact of causing more crowding and congestion of rafting groups at common bottleneck areas. The visual effect of seeing crowds of rafters and rafts in an area would be a negative short-term impact to scenic quality. By managing the planning area to allow and encourage more recreational use, the risk of human ignited wildfire increases, the potential to see more people and vehicles increases, and the potential to view more developed, larger recreation facilities increases. The negative impacts caused by allowing more commercial and private white water boating would have its greatest negative impacts to scenic quality in this alternative when compared to the other alternatives.

The construction of interpretive displays, brochures, environmental education efforts, could have an indirect beneficial impact on scenic quality by fostering a greater appreciation and stewardship ethic amongst visitors to the planning area. This type of visitor would be more likely to take an active role in helping to maintain and improve scenic quality by volunteering to help with vegetation treatments or clean up projects, noting and reporting illegal activities that might jeopardize scenic quality, and advocating for scenic quality resources in the political arena.

Creating designated OHV travel routes and restricting motorized travel to designated roads would have the beneficial impact of lessening the amount of visual damage to meadows caused by unrestricted, cross country OHV use.

Designating the Klamath River trail from Frain Ranch to the Turtle camp area for motorized use, would have the impact of introducing more vehicles to the riverside, an unnatural scenic element that would detract from scenic quality.

Additional recreation facilities in Segment 1 for boating and fishing would have little to no negative impact to scenic quality in that area.

Road Management - The proposed road treatments to widen and resurface the major access roads to the planning area, Topsy road and Boyle access road, could cause indirect, significant, negative impacts to scenic quality. This action could introduce a wider variety of visitors, and a large increase in the number of visitors to the area. This would have the effect of detracting from the natural appearance of the area. The proposed management of four bridges, open to all types of travel, would also contribute to a greater number and variety of people and vehicles in the area. The bridges would also have the effect of drawing more attention to nearby roads that currently are mostly hidden in the background of the view from the river. The construction of two new bridges, located at the upper end of Frain ranch and Stateline, would impact scenic quality by introducing major cultural modifications to otherwise natural appearing landscapes (see Map 20a).

Vegetation Management - These treatments, designed to increase vegetative and biological diversity would, in some cases, have short-term negative affects. While mitigation measures and treatments would be designed to minimize negative affects, some short-term negative affects would at times be visible. Such affects would include small piles of brush and small trees, small tree and brush stumps cut close to ground, and some ground disturbance from mechanized equipment. Other very short-term affects would include dust and smoke.

In many cases, vegetation treatments would enhance scenic quality. Some of these treatments would enhance existing scenery, by targeting areas near recreation sites or along roads that lack vegetative diversity. Treatments would be designed to enhance areas where existing vegetation such as large old growth trees or geologic features are hidden due to overstocked stands or decadent, old brush. For example, additional scenic vistas may be created through careful vegetation manipulation along Topsy Road and elsewhere. Targeted vegetative plantings would be used to improve scenic quality where vegetation is lacking, or to screen culturally modified areas from view (see Map 24).

Aquatic Species/Habitat Management - Management activities such as channel improvement/restoration, placement of large woody debris, and reconstruction of irrigation diversions, all have the potential to create short-term impacts to scenic quality. The presence of heavy equipment in the river, piles of materials stockpiled in central areas, and heavy helicopter traffic, could cause enough degradation to scenic quality to prompt negative perceptions of management actions and generate complaints to BLM, PacifiCorp, and other managing entities.

Proposed treatments that would restore large, woody debris to the river and stream banks would be located in areas that are highly visible and accessible to visitors. This action could negatively impact scenic quality during project construction (see Map 28).

Cumulative Impacts - Opportunities for maintaining primitive, natural appearing landscapes would be less likely under this alternative when compared to the other alternatives. Most roads, including primary access routes and facilities would be greatly improved. This would allow access to low clearance vehicles, likely increasing the amount and type of visitation into the area.

The greatest change to the scenic quality would be expected under this alternative. Greater crowding of facilities, developed facilities where there is presently limited or no development, improved motorized access and greater visitor contact would likely change the character of the scenic quality and visual resources in the planning area. It would be more difficult to maintain the standards for BLM VRM class II management of the planning area. This change in scenic quality may be great enough that the "scenic" ORV would not be maintained.

Irretrievable, Irreversible, and Unavoidable Impacts

Opportunities for viewing a very primitive, natural appearing landscape would be decreased or lost. The continued use of the Klamath River Edge trail from Frain Ranch to the Turtle camp area for motorized access would be an unavoidable impact to scenic quality near the river. The proposed developments such as recreation facilities, roads, bridges, and trails would irretrievably impact scenic quality. Alternative 4 would have the greatest unavoidable negative impacts to scenery when compared to the other alternatives. The landscape would appear more modified and developed with more intrusions and a less natural appearance.

Vegetation treatments proposed in all alternatives would help maintain or enhance scenery management. The treatments would have short-term negative impacts to scenery but the long-term benefits for maintaining or enhancing scenery. Fuel loading would be reduced, further protecting scenery from wildfire. A large-scale catastrophic wildfire would have irretrievable impacts to the scenic quality by burning down vegetative communities that would require 50-150 years to return. The most positive benefits would be in Alternative 3.

PacifiCorp structures and facilities of the J.C. Boyle hydroelectric project, such as water canals, emergency spillway, forebay, penstocks, transmission lines, substation, and power station, would have unavoidable negative impacts to scenic quality. The impact of some of these facilities may be addressed during the FERC relicensing process of the Klamath hydroelectric project.

Recreation

Assumptions

People visit the upper Klamath River canyon to gain a variety of outdoor recreation experiences. The types of experiences gained depend upon a combination of three factors: environmental (developed versus undeveloped landscape), managerial (less versus more restrictions or management controls) and social (fewer versus greater contacts with visitors). In the planning area, the primary variation by alternative is the relative change in the proposed level of development of recreation sites, trails and use areas to meet or exceed anticipated demand. Another primary variation is the amount of emphasis on motorized versus non-motorized recreation, and the level of improvements to the roads and transportation network.

Under all alternatives it is anticipated that dispersed recreation use would increase over the present. Each alternative that follows discusses anticipated recreation demand and how the plan addresses recreation use and developments, through monitoring and management actions.

It is anticipated that the selected alternative's recreation sites, trails and use areas, including any proposed projects would be maintained over time, in order to continue to meet public demand and visitor health and safety concerns. These actions would include the evaluation and removal of hazard trees and limbs as necessary to protect visitor safety. All proposed recreation project developments are contingent upon adequate funding for implementation.

Some proposed projects would require management agreements between BLM, PacifiCorp and other entities, BLM acquisition or PacifiCorp development.

Implementation of any recreation action proposed on private land or land managed by an agency other than the BLM will be contingent upon approval from the affected land owner or agency. This includes restrictions on target and varmint shooting, which would be implemented (to varying degrees) under all alternatives (contingent upon cooperation with Oregon Department of Fish and Wildlife, Oregon State Police and Klamath County Sheriffs Department). These restrictions would be placed in order to address a legitimate public concern and protect public welfare and property from unregulated shooting. Recreation actions that are linked to other proposed actions would, when practicable, be sequenced so as not to cause undue reductions in recreation access that would complicate implementation of the related project.

Impacts Common to All Alternatives

Scenery Management - Management actions designed to maintain, enhance or improve the river's scenic quality would benefit those recreationists seeking more primitive recreation experiences. Modifications to existing facilities, and existing roads would lessen existing negative visual impacts. Enhancing landscaping and visual screening at camping/day use areas would benefit the recreationist's experience. Vegetation treatment projects designed to reduce risk for catastrophic wildfire (long-term) would receive visual resource design review to have acceptable short-term visual resource impacts.

Recreation Facilities and Management - Facility development and maintenance would positively affect those visitors preferring primitive experiences may see facility development as a negative affect on their experience. However, abundant opportunities for more primitive recreation experiences away from developed facilities will be available.

Road Management - Motorized travel would be limited to designated "open" roads. Road closures and obliterations, using physical barriers and other means (fencing, etc.) would be used to discourage motorized vehicle use off of existing roads. This would help to decrease impacts to other resources from unregulated OHV use. Additional developed day use and camping on Topsy Reservoir (outside planning area) may need to be developed to meet future demands.

The following is common to Alternatives 1, 2 and 3 only: Road treatments designed to reduce erosion and vehicle rutting (through surface treatments) would keep motorized travel on existing roads (and out of meadows), while maintaining the semi-primitive motorized recreation experience. To maintain this semi-primitive motorized recreation experience, road treatments would be designed for the passage of high clearance and 4-wheel drive vehicles only. Some roads presently available for a semi-primitive motorized experience would be permanently closed and rehabilitated, seasonally closed, available for administrative access only or converted to non-motorized trails and this would reduce opportunities for recreational driving.

Cultural Resource Management - For protection of historic and prehistoric resources, user-developed, duplicate or unimproved roads and primitive camp sites may be closed and rehabilitated to prevent further resource degradation. In addition, some cultural sites may be capped with soil and re-vegetated to protect them from further OHV damage. These management actions would cause a long-term displacement of some existing motorized recreation use of these roads and sites, primarily on PacifiCorp lands in Oregon and California. Enhancing interpretation of cultural resources through displays, brochures and direct contact with recreationists would improve the visitor experience and increase awareness to protecting these valuable resources.

Vegetation Management - Prescribed fire and thinnings designed to increase vegetative and biological diversity would, in some cases, have short-term negative affects on recreation users. While mitigation measures and treatments would be designed to minimize these affects, some short-term negative affects would at times be visible to recreationists near recreation sites and use areas. Such effects would include small piles of brush and trees, small tree and brush stumps cut close to ground, and some ground disturbance from mechanized equipment. Other very short-term affects would include some localized exhaust smoke, noise dust from saws and machinery and smoke from controlled burns.

Vegetative treatments designed to reduce fuel loadings and ladder fuels would have positive long-term benefits to recreationists by reducing the likelihood of catastrophic stand replacing wildfires. Recreation sites use areas and existing opportunities would receive long-term protection from destructive wildfires. While all catastrophic wildfires might not be able to be prevented, vegetative treatments would reduce the risk, which would benefit recreation use. In many cases, vegetation treatments would enhance the recreation experience by increasing scenic and wildlife diversity. Some of these treatments would enhance existing scenery, by targeting areas near recreation sites or along roads that lack vegetative diversity. Treatments would be designed to enhance areas where existing vegetation such as large old growth trees or geologic features are hidden due to overstocked stands or decadent, old brush. For example, additional scenic vistas may be able to be created through careful vegetation manipulation along Topsy Road and elsewhere. Targeted vegetative plantings would be used to improve scenic quality where vegetation is lacking, or to screen culturally modified areas from view.

Terrestrial Species/Habitat Management - Improving habitat and structures for game birds (especially turkeys) and waterfowl would enhance game bird/waterfowl hunting opportunities. Road closures, vegetative treatments and wildlife structures should increase wildlife availability for hunting and viewing. In general, vegetation treatments or structures designed to enhance vegetation diversity and attract wildlife would have a positive long-term affect on recreation through increased opportunities for wildlife viewing and hunting.

Watershed Management Actions - Improved water quality and riparian vegetation conditions would have a positive benefit on recreationist's experiences and scenic quality.

Range Management - If cattle grazing were to resume, it would primarily be on PacifiCorp lands within the river corridor. Cattle grazing in the Frain Ranch area would have a negative impact to recreationists who find cattle objectionable. Cattle grazing in the Frain Ranch area and along the riverbanks in Segment 3 have caused trampled riparian vegetation, and denuded riverbanks.

Wild Horse Management - Wild horse management would have little or no impact on recreation. When wild horses are present in the canyon, they are typically considered to be beneficial to the recreation experience, much like viewing other wildlife.

Fire and Fuels Management - By reducing fuel loadings through prescribed fire and vegetative treatments, the long-term goal of reducing the chance of a catastrophic wildfire is more likely achieved. By reducing the chance of a catastrophic wildfire, both short and long-term objectives of maintaining scenic quality, recreation sites and use areas, and existing recreation opportunities would more likely be achieved. There would be short-term negative impacts to recreation visitors from noise, exhaust smoke and dust from mechanized fuel treatments, and from smoke, blackened tree boles and dead brush from prescribed fire activities.

Impacts of Specific Alternatives

(Refer to Maps 3, 13-16, 17a-20a, 21-28 and Table 5-1 and Appendix H)

Alternative 1

Scenery Management - See "Impacts Common to All Alternatives".

Recreation Facilities and Management - See "Impacts Common to All Alternatives". In addition, this alternative allows for the greatest unrestricted Off-Highway Vehicle (OHV) use, camping and other dispersed activities. This alternative benefits those recreationists seeking unstructured recreation with little controls on motorized access and a limited law enforcement presence. Existing road closures are minimal and cause little inconvenience to motorized access. Additional road closures and rehabilitation could occur, but other, nearby routes would be provided. Topsy Road would be nominated for designation to the National Back Country Byway System, which would highlight this historical stagecoach route. A slight increase in OHV traffic along Topsy Road would be expected from this designation (see Map 13).

Unrestricted target and varmint hunting (except where presently posted "No Shooting") would continue to occur, negatively affecting whitewater boaters and others intimidated by this recreational activity. There is a risk of an accidental shooting, mishap or even death from continued, unrestricted firearm use along the river's banks.

Most California PacifiCorp lands would continue to remain unavailable to the general public for hunting or other recreation activities.

Fishing access along Segment 1 would remain very primitive, and accessible only to those willing to challenge steep, rocky terrain. Barrier free access to fishing would be primarily limited to Topsy Recreation site and Spring Island River Access. Opportunities for kayaking and boating in Segment 1 would continue to be limited to times of high flow during spring and early summer. In Segment 2, river rapid scouting trails would likely be improved; however, dedicated non-motorized hiking trails would be limited.

River flows suitable for whitewater boating in Segments 2 and 3 would be expected to be maintained, however the timing of water releases would probably continue to be shifted to later in the afternoon. From 1980 to 1999 hydropower water releases allowed mid-morning float launches. Since 1999, water releases have shifted from mid-morning to later in the day, for hydropower production purposes. This shift in the timing of flows, from what has been traditional or historical, is negatively affecting commercial whitewater boating companies operation, and resulting revenues.

The commercial whitewater boating industry on the upper Klamath River became established in the early 1980s. Most companies were able to take advantage of a reliable and consistent flow pattern of mid-morning water releases, and marketed their trips with this consistency in mind. Based on discussions and several meetings with PacifiCorp, BLM and commercial whitewater boating companies, PacifiCorp worked with the commercial whitewater industry when possible to accommodate the timing of flows to benefit both hydropower production and rafting.

With a shift in the timing of water releases to later in the day, the number of commercial whitewater boating companies would be expected to stay the same or decline, especially if the availability of new commercial permits continues to be frozen and commercial operations become more difficult. The numbers of commercial trips and passengers would decrease, as it becomes more difficult to sell or market float trips later in the day. Pursuing consistent river flows, to provide for mid-morning launches, would improve commercial boating marketability/viability while maintaining the Scenic River recreational ORV.

Road Management - See "Impacts Common to All Alternatives". In addition, motorized access to primitive campsites and fishing presently available along the river near the old bridge site north of Frain Ranch (river left), and along the river northwest of Frain Ranch (river right) would be permanently closed. This would be a long-term permanent loss of motorized recreation access to primitive camping and fishing sites along this stretch of the river, however, non-motorized recreation and solitude opportunities would be improved. Most California PacifiCorp lands would continue to remain unavailable for motorized travel. Abundant opportunities for motorized travel throughout the planning area would still be available (see Map 17a).

Road management, especially construction of new roads or closure/decommissioning of existing roads not only affects the miles of road open to vehicle travel, but also tends to concentrate recreation use. The majority of visitors traveling by vehicle tend to recreate a very short distance (often 1/4 mile or less) from where they park. To give an indication of the effect that road system management has on the amount of access, the area within 1/4 mile of each open road was calculated. For Alternative 1, about 523 acres would be accessible from motorized vehicles in Segment 1, about 3,145 acres in Segment 2, and about 1,265 acres in Segment 3 (refer to Table 5-1).

Cultural Resource Management - See "Impacts Common to All Alternatives".

Vegetation Management - Alternative 1 proposes limited vegetative treatments, compared to the other alternatives. Limited vegetative treatments would not sufficiently reduce fuel loadings and reduce the risk of catastrophic wildfires. A catastrophic wildfire would cause a long-term impact to recreationists through a drastic reduction in vegetative diversity and scenic quality, and through the loss of recreation sites, use areas and opportunities (see Map 21).

Terrestrial Species/Habitat Management- See "Impacts Common to All Alternatives".

Watershed Management Actions - Improved water quality and riparian vegetation conditions would have a positive benefit on recreationists' experiences and scenic quality along the river.

Continuing to pursue the pending water rights claim for 1500 cfs during the primary whitewater use period would maintain the Scenic River recreation outstandingly remarkable value (Segment 2).

The closure of some roads parallel to the river or streams, to protect riparian values, should have minimal impact on most motorized recreation access (see Map 17a). Many of these road closures are proposed where road access is duplicated or available nearby (see above Road Management section for a discussion of long-term impact to primitive camping and fishing access due to road closures). The installation of barriers to prevent access across wet meadows would have a minor long-term negative affect on those OHV enthusiasts that enjoy driving across meadows. These users would likely seek out other nearby unregulated areas with similar qualities.

Aquatic Species/Habitat Management - Since Alternative 1 proposes little new enhancement of fish habitat or passage, the recreational fishing opportunities should remain fairly stable. Providing interpretive panels on fish habitat, history and recreational fishing opportunities would improve education efforts (see Map 25).

Range Management - See "Impacts Common to All Alternatives".

Fire and Fuels Management - Alternative 1 provides for the least prescribed fire treatment acres of all the alternatives. Therefore, the long-term goal of reducing the chance of catastrophic wildfire may not be achieved in time to prevent unavoidable impacts to

recreation. Recreation sites use areas and the desired recreation experiences are presently threatened by the likelihood of wildfire. Therefore, Alternative 1 may have long-term negative impacts to recreation and scenic quality.

Cumulative Impacts - In this alternative, one developed campground (Topsy), and several designated dispersed campsites and developed day use sites would be available for public use. New trails would be constructed to provide additional non-motorized recreation opportunities, and meet an existing demand. Motorized tour routes would be identified. The overall recreation facility development scenario would provide a spectrum of recreation opportunities, from developed campgrounds to primitive campsites, and from semi-primitive motorized access to primitive non-motorized trails. Management controls, regulations and patrols would remain present but at a level which is subtle to most visitors. Public access to the planning area would be improved, with some access within certain areas reduced, although similar access will remain with other existing roads.

Recreation use such as fishing and camping will be expected to remain near the present level and increase slightly over time due to limited road improvements and developed facilities. Whitewater boating use may be expected to remain near current levels, with slight decreases over time if the timing of water releases continues to be later in the day. Some displacement of OHV visitors would be expected as roads and areas presently used are closed or rehabilitated.

Limited vegetation management (compared to the other alternatives) would not sufficiently reduce fuel loadings and reduce the risk of catastrophic (forest stand replacing) wildfires. Increased water quality and quantity would benefit the recreational experience.

Alternative 2

Scenery Management - See “Impacts Common to All Alternatives”.

Recreation Facilities and Management - Alternative 2 provides additional developed camping, day use sites, interpretive facilities, non-motorized trails and designated OHV routes that would benefit those recreationists seeking a more structured recreation experience while maintaining abundant opportunities for dispersed, more primitive recreation and solitude (see Map 14).

Off-highway vehicle (OHV) tour routes would be designated on existing roads, signed and have informational brochures to provide scenic tour opportunities for users. This would improve management of existing OHV use, through information/education efforts while improving long-term protection of resource values associated with these routes. Opportunities for organized tours (regulated with permits) would be recommended on some Segment 3 semi-primitive roaded PacifiCorp lands (not currently open), assuming management agreements or BLM acquisition were pursued. While motorized use on designated tour routes is expected to increase over the present, long-term resource damage to roads and other resources is expected to decrease, due to better road management, education and partnership efforts.

Proposed additional law enforcement patrols, along with educational efforts, would also reduce vandalism and increase compliance with regulations. However, it would be necessary to secure funding from grants, PacifiCorp and others to provide the additional law enforcement patrols.

Unregulated target shooting and varmint hunting would be restricted from about one-half of the planning area during the summer season. While this management action would displace this activity to areas outside of camping and visitor use areas during a portion of the year, visitor safety would be significantly improved. Additional areas for non-motorized target shooting and hunting would be available on some Segment 3 (California) PacifiCorp lands,

assuming management agreements or BLM acquisition were pursued. This would be a long-term benefit for hunters, as these areas are presently closed to public access.

Access to some places will be improved, therefore, some primitive, difficult to use (non-developed), fishing access opportunities would be eliminated under this alternative. Some opportunities for solitude would be permanently lost.

Fishing opportunities, especially in Segment 1, would be significantly improved under this alternative, with several new fishing access trails and parking areas being developed. In Segment 2, additional trail access would also provided, to areas presently inaccessible. With this improved fishing access, accessibility for those with disabilities would be provided at several sites in Segments 1, 2 and 3 (presently available at only one site each in Segment 1 and 2).

A wide variety of camping opportunities would be available/provided. Fully developed campgrounds, with on-site caretakers would continue to be available at Topsy Reservoir, including a new campground in Segment 3 (Shovel Creek site). New and additional designated campsites and relocation of some existing facilities in Segments 2 and 3, would reduce resource damage and provide for human waste containment. Non-motorized, dispersed camping would continue to be available. Additional areas for dispersed camping would be available on some Segment 3 (California) PacifiCorp lands, assuming management agreements or BLM acquisition was completed. This would be a long-term benefit for those seeking primitive camping, as these areas are presently closed to public access.

Several new trails would greatly improve nonmotorized recreation opportunities and access to remote areas. New footbridge in the Frain Ranch area would greatly expand loop trail opportunities. Existing rapid scouting trails would be upgraded, improving boater safety. New areas would be available for non-motorized recreation on Segment 3 (California) PacifiCorp lands, assuming management agreements or BLM acquisition were completed. This would greatly expand hiking, mountain biking and horseback riding opportunities in an area that is presently closed to public access. At times, non-motorized recreationists would share area access with permitted, organized OHV tour groups.

Boating and kayaking river access would be provided on PacifiCorp lands (assuming management agreements or BLM acquisition were completed) in segment 1 (assuming enhanced river flows), and improved in segment 2 (Frain ranch), and in segment 3 (Stateline and at Fishing Access 6), and at Fishing Access 1 immediately outside the planning area. Pursuing consistent river flows, to provide for mid-morning launches, would improve commercial whitewater boating marketability and viability while maintaining the scenic river recreational ORV.

Motorized boating would be unavailable permanently in all segments under this alternative, except by special use authorization, such as for conducting scientific research or movie production. Motorized boating use is currently non-existent or at a miniscule level due to naturally occurring restrictions such as shallow, rough and rocky river sections, and extremely difficult and numerous rapids.

Interpretive/environmental education efforts and day use opportunities would be improved and expanded. These efforts would be designed to improve visitor information services, while increasing visitor compliance with rules and regulations and reducing vandalism and resource damage. Additional developed day use and scenic overlook sites would enhance the recreational experience by highlighting educational opportunities and scenic vistas.

Many of these development proposals are located on PacifiCorp lands, in Oregon and California. To achieve these developments, management agreements, BLM acquisitions or PacifiCorp development would be necessary. In addition, it would be necessary to acquire funding or grants from PacifiCorp for increased law enforcement and for enhancing or developing recreation facilities.

Road Management - Under this alternative, several roads presently available for a semi-primitive motorized experience would be permanently closed (due to road decommissioning), seasonally closed, available for administrative access only, or converted to non-motorized trails (see Maps 18a and 18b). Compared with Alternative 1, opportunities for relatively unrestricted OHV use would be permanently lost. In general, road decommissioning and closures would slightly reduce motorized access to the planning area for recreation opportunities. Abundant opportunities for motorized travel would still be available, however.

Motorized access to primitive campsites and fishing presently available along the river near the old bridge site area north of Frain Ranch (river left), and along the river northwest of Frain Ranch (river right) would be permanently closed. However, short spur roads would be constructed to provide access to several newly designated campsites in these areas. Several other duplicate roads would be recommended to be closed in the Frain Ranch area. These road closures would be a permanent loss of motorized recreation access to primitive camping and fishing sites along this stretch of the river, however non-motorized recreation and opportunities for solitude would be improved. PacifiCorp lands in California would continue to remain unavailable for motorized travel, except for areas where organized tours (regulated with permits) are being proposed.

Road management, especially construction of new roads or closure and decommissioning of existing roads not only affects the miles of road open to vehicle travel, but also tends to concentrate on recreational use (see Map 18a). The majority of visitors traveling by vehicle tend to recreate a very short distance (often 1/4 mile or less) from where they park. To give an indication of the effect that road system management has on the amount of access, the area within 1/4 mile of each open road was calculated. For Alternative 2, about 356 acres would be accessible from motorized vehicles in Segment 1, about 2,975 acres in Segment 2, and about 1,514 acres in Segment 3 (refer to Table 5-1). Relative to Alternative 1, this alternative would entail a 32 percent reduction in motorized access in Segment 1, a five percent reduction in Segment 2, and a 16 percent increase in Segment 3.

Cultural Resource Management - See “Impacts Common to All Alternatives”.

Vegetation Management - Alternative 2 would increase vegetative treatments compared to Alternative 1. This would provide additional areas with reduced fuel loadings and thereby reduce the risk for catastrophic wildfires to occur. Disturbance to the recreating public from use of equipment (noise and dust) and smoke from prescribed fire would have short-term impacts (see Map 22). Terrestrial Species/Habitat Management - Alternative 2 would provide enhanced wildlife viewing and hunting opportunities through greater types of habitat improvements and structures, compared to Alternative 1.

Watershed Management Actions - Pursuing increased water flows for the Bypass Reach (Segment 1) on weekends during spring through fall, and increased instream flows for fish habitat and passage at other times, would greatly enhance kayaking and boating opportunities. This would lead to increased whitewater boating use in the Bypass Reach (where there is presently a miniscule amount). This whitewater use would be managed to maintain the semi-primitive recreation experience (see Appendix H, Recreation, Private Boating and Commercial Boating for management recommendations). Continuing to pursue the pending water rights claim for 1500 cfs during the primary whitewater use period would maintain the scenic river recreational outstandingly remarkable value (Segment 2).

The closure of roads parallel to the river or streams should have minimal impact on most motorized recreation access. (See above Road Management section for discussion of long-term impacts to primitive camping and fishing access from road closures). Many of these road closures are proposed where road access is duplicated or available nearby (see Map 18a). The installation of barriers to prevent access across wet meadows would have a minor long-term negative affect on those OHV enthusiasts that enjoy driving across meadows. These users would likely seek out other nearby unregulated areas with similar qualities.

Aquatic Species/Habitat Management - Enhancing fish habitat and passage through riparian/vegetation treatments, structural changes and channelization efforts should positively affect recreational fishing opportunities by increasing numbers and sizes of resident fish. Providing for enhanced fish passage at J. C. Boyle dam should improve fishing opportunities by enhancing the ability of native fish to migrate above and below the dam. Enhancements at the J. C. Boyle fish ladder should increase opportunities for viewing fish and interpretation of fish migration patterns. Removal of sidecast material and installation of bankfull benches along the Bypass reach affected by the canal would enhance the recreation experience with the subsequent creation of a hiking trail and fishing access along this reach. Channel width treatments would have long-term benefits of enhancing opportunities for whitewater boating (by creating additional, deeper rapids), and recreational fishing (through the creation of additional deep pools).

Range Management - See "Impacts Common to All Alternatives".

Fire and Fuels Management - See "Impacts Common to All Alternatives". In addition, Alternative 2 increases the use of prescribed fire and vegetative treatments as a management tool to reduce fuel loadings (compared to Alternative1). This would more likely achieve both short and long-term goals of reducing the risk of catastrophic wildfires. By reducing the risk of wildfires, scenic quality, desired recreation experiences, and recreation sites would be maintained. However, under Alternative 2, there would be greater short-term negative impacts to recreation visitors. This is because there would be increased noise and dust from more fuel treatment areas, and more smoke, blackened tree boles and dead brush from increased prescribed fire activities.

Cumulative Impacts - In Alternative 2, two developed campgrounds (Topsy and Shovel Creek) would be provided, and additional designated dispersed campsites and developed day use sites would be available for public use (compared to Alternative 1). Barrier free access to facilities and existing trails would be improved. New trails would be constructed to provide additional non-motorized recreation opportunities, including providing fishing access to Segment 1 (Bypass reach). Some primitive, difficult to use fishing access and solitude opportunities would be unavailable. New footbridge access would be provided near Frain Ranch and Shovel Creek. Additional motorized tour routes would be identified, in conjunction with increased OHV and other educational efforts. The overall recreation facility development scenario would provide a spectrum of recreation opportunities, from developed campgrounds to primitive campsites, and from semi-primitive motorized access to primitive non-motorized trails. Management controls, regulations and patrols (i.e., management setting) would remain present but at a level which is subtle to most visitors. However, this managerial setting would be at a higher level than Alternative 1, and may cause some recreationists to seek out more primitive or less structured areas. Public access to the planning area would be improved for safer travel, along with a reduction in road access, although access will remain with other nearby roads. Some opportunities for primitive (non-designated) camping would be lost due to road or campsite closures or improvements to existing campsites.

Recreation use such as fishing and camping will be expected to remain near the present level and increase slightly over time due to limited road improvements and developed facilities. Whitewater boating use may be expected to remain near current levels, with slight increases over time, if the timing of water releases provide for mid-morning launches. Kayaking and boating opportunities would be expected to improve with more consistent flows, especially for Segment 1. Motorized boating would be permanently unavailable in all segments, except under special use authorization. Some displacement of OHV visitors and loss of OHV opportunities would be expected as roads and areas presently open are closed or rehabilitated. Additional firearm use restrictions in about one-half of the planning area would be implemented to protect visitors and property. Some opportunities for primitive (non-designated) camping would be lost due to road or campsite closures or improvements to existing campsites.

Increased vegetation management (compared with Alternative 1) would help to reduce fuel loadings and the risk of catastrophic (forest stand replacing) wildfires. Increased water quality and quantity would benefit the recreational experience.

Alternative 3

Scenery Management - See "Impacts Common to All Alternatives".

Recreation Facilities and Management - Alternative 3 provides limited developed camping, day use, interpretive facilities and non-motorized trails that would benefit those recreationists seeking a less structured recreation experience (see Map 15). The greatest opportunities for dispersed, more primitive recreation and solitude would be available under this alternative.

Off-highway vehicle (OHV) users would face the greatest restrictions in Alternative 3. The greatest reduction in designated roads open to OHV travel would be made in Alternative 3, compared to other alternatives. More restricted travel would also be recommended for PacifiCorp lands in Segment 2. More restricted travel would be recommended for PacifiCorp lands in Oregon. No OHV tour routes would be designated and signed under this alternative. Segment 3 semi-primitive roaded PacifiCorp lands would remain closed to motorized use, continuing the existing level of resource protection. Better management of OHV use would also occur through information/education.

While motorized use of existing roads is expected to stay the same or slightly increase over the present, long-term damage to roads and other resources is expected to decrease, due to better road management, educational and partnership efforts. Existing law enforcement patrols, along with other visitor contact efforts, would likely be reduced, increasing the potential for vandalism and decreasing compliance with regulations.

Fishing access in segment 1 would remain similar to the existing situation (Alternative 1). Under this alternative, no new river access trails or parking areas would be provided in segment 1. The bypass canal access road would be available for non-motorized use only, as would the bridge immediately below J.C. Boyle Dam. In segment 2, additional trail access would also provided, to areas presently inaccessible. Accessibility to those with disabilities would remain similar to the existing situation, with access provided at Topsy Recreation Site and Spring Island launch site.

Opportunities for unregulated target shooting and varmint hunting would be restricted during the summer season in all segments under this alternative. While this management action would displace this activity to areas outside of camping and visitor use areas during a portion of the year, visitor safety would be significantly improved.

Fewer developed camping opportunities would be available compared to the other alternatives. A fully developed campground, with on-site caretakers, would continue to be available, but only at Topsy campground. The closure of the access road and relocating of campsites in the Klamath River Campground, to above the riparian reserve, would impact those campers desiring an improved camping area next to the river. No additional developed camping facilities would be provided in Segment 1, 2 or 3, to reduce resource damage and provide a more "rustic" camping experience.

The closure of the lower bench area at Stateline Recreation Site to motorized recreation would negatively impact those boaters, fishermen and campers that use this river access area. Under Alternative 3, PacifiCorp Fishing Access #6 is proposed for development as a substitute area for overnight camping and river access. Even if Fishing Access #6 were to be developed for camping, it would not provide a similar level of solitude, or the more natural and remote setting the Stateline lower bench area at provides. This is due to its close proximity to the access road, and lack of suitable shade trees with level, smooth camping sites.

Several existing designated dispersed camps and user created camps would be permanently closed and rehabilitated. Stateline Recreation Site lower bench area (BLM land) would be permanently closed to motorized access and camping. Replacement campsites would be provided at the upper Stateline bench and at Fishing Access #6, if PacifiCorp lands were available for development. This would cause a moderate increase in recreation use level at this site and require an increased level of existing development and maintenance. Non-motorized, dispersed camping would be available throughout the planning area.

Several newly constructed trails and roads converted to trails would be provided, greatly enhancing non-motorized recreation opportunities and access to remote areas. However, no new bridges would be provided, eliminating loop trail opportunities. Existing user created, rapid scouting trails would be improved.

Kayaking opportunities would likely become available year-round in Segment 1 (assuming enhanced river flows for fisheries). However, whitewater boating opportunities may be greatly reduced during the summer months, in Segments 2 and 3 (assuming reduced/stabilized flows for fisheries). Permitted boating numbers would subsequently be reduced, enhancing the semi-primitive recreation experience for those boaters able to conduct a float trip (see Appendix H, Recreation, Private Boating and Commercial Boating for management recommendations). However, this would have long-term negative impacts to commercial whitewater boating companies and opportunity for boaters to choose float days.

Interpretive/environmental education efforts and day use opportunities would be improved and expanded over the existing situation (but at a reduced level from Alternatives 2 and 4). These efforts would be designed to improve visitor information services, while increasing visitor compliance with rules and regulations and reducing vandalism and resource damage. Only limited day use and scenic overlook sites would be available along Topsy Road, reducing the recreational experience and educational opportunities (compared with Alternatives 2 and 4). Existing user created overlooks at Hell's Corner and Salt Caves would be closed to motorized travel.

Road Management - Alternative 3 would receive the most extensive road closures, seasonal use restrictions and road restoration efforts of all alternatives (see Map 19a). Road mileage reductions would decrease motorized travel opportunities. Road treatments designed to reduce erosion and vehicle rutting (through spot surface treatments or road relocation) would help keep motorized travel on existing roads (and out of meadows). The opportunities for a semi-primitive motorized recreation experience would be reduced under this alternative, as many roads are improved for resource protection.

Many roads presently available for a semi-primitive motorized experience would be permanently closed or converted to non-motorized use. This reduction in access in the planning area would be a long-term negative impact to motorized recreation compared to the other alternatives. However, opportunities for activities such as hiking, biking and horseback riding away from vehicle traffic would be greatly increased under this alternative. Additional non-motorized trails not currently open to public use would be available in Segment 3 in California (assuming management agreements or BLM acquisition of PacifiCorp lands was completed).

Road management, especially construction of new roads or closure/decommissioning of existing roads not only affects the miles of road open to vehicle travel, but also focuses recreation use. The majority of visitors traveling by vehicle tend to recreate a very short distance (often 1/4 mile or less) from where they park. To give an indication of the effect that road system management has on the amount of access, the area within 1/4 mile of each open road was calculated. For Alternative 3, about 356 acres would be accessible from motorized vehicles in Segment 1, 2,828 acres in Segment 2, and 1,182 acres in Segment 3 (refer to Table

5-1). Relative to Alternative 1, this alternative would entail a 32 percent reduction in motorized access in Segment 1, a 10 percent reduction in Segment 2, and a six percent reduction in Segment 3.

Cultural Resource Management - The restoration and rehabilitation of historic structures under Alternative 3 would enhance the recreation experience by providing for the long-term availability for viewing and interpretation of these important structures.

Vegetation Management - Alternative 3, with the greatest amount of vegetation treatment acres would, in some cases, have the greatest opportunity for short-term negative effects on recreation users (see Map 23). This would be because of increased noise, dust and smoke from greater amounts and types of vegetative treatments. There would also be greater numbers of stumps and small tree and brush piles which some recreationists may find disagreeable.

The installation of barriers to prevent access across wet meadows would reduce the area OHV users have used in the past.

Terrestrial Species/Habitat Management - Under Alternative 3, the greatest amount of vegetation treatments would be conducted to restore vegetation diversity that would maintain and enhance wildlife populations. This should have a positive long-term effect on recreation activities through increased opportunities for wildlife viewing and more primitive hunting. There would be a short-term negative effect from additional noise, dust, and smoke from greater amounts and types of vegetative treatment. However, the closing of roads and recreation sites for protection of wildlife species (ex: Frain Ranch and Klamath River campground) would reduce the amount of roads for hunting access and developed sites available for motorized camping.

Watershed Management Actions - The likely reduction in available water releases for whitewater rafting in Segments 2 and 3 would negatively affect recreation (see Cumulative impacts section). Compared to the other alternatives, Alternative 3 would close additional roads and recreational developments and use areas within riparian reserves (see Map 19a). This would reduce the availability of designated sites and primitive camping areas available for motorized camping, and would be a long-term negative impact to dispersed recreationists.

Pursuing increased water flows for the Bypass Reach (Segment 1) on weekends during spring through fall, and increased instream flows for fish habitat and passage at other times would greatly enhance kayaking and boating opportunities. This would lead to increased whitewater boating use of the Bypass Reach (where there is presently a miniscule amount).

Aquatic Species/Habitat Management - Enhancing fish habitat and passage through riparian/vegetation treatments, riverbank structural changes and channelization efforts should positively affect recreational fishing opportunities by increasing numbers and sizes of resident fish (see Map 27). Providing for fish passage would enhance the diversity of fishing opportunities by re-establishing native anadromous fisheries currently available only below Iron Gate Reservoir. Enhancements at J.C. Boyle Dam fish ladders should increase opportunities for viewing fish and interpretation of fish migration patterns.

If emergency water release chute under this alternative was removed rather than rebuilding or retrofitting it, the present safety concerns for fishermen from unexpected emergency flow releases along the Bypass reach would be eliminated. Extensive channel width treatments may provide additional whitewater boating opportunities at reduced water release levels (by creating a narrower river channel and deeper rapids), and recreational fishing (through the creation of additional deep pools and more stabilized flows). The removal of most or all stream channel irrigation diversions would eliminate or reduce the size of some existing man-made rapids in Segment 3. This could negatively affect the whitewater boating experience, although these rapids are in the flatter section of the river. The addition of large logs into the

river channel would create additional obstacles, and increase potential safety hazards to whitewater boating.

Range Management - Under Alternative 3, cattle grazing would likely only occur to meet other management or restoration objectives. This would benefit those recreationists who find cattle objectionable.

Fire and Fuels Management - Under Alternative 3, greater short-term negative effects, (such as additional blackened tree boles and dead brush and trees) would be visible to recreationists through the increased use of prescribed fire. However, recreationists would have long-term benefits from maintenance and enhancement of forest and range health. These benefits would include the long-term maintenance of scenic quality and values, recreation sites and use areas and existing recreation opportunities.

Cumulative Impacts - In this alternative, one developed campground (Topsy), and limited designated dispersed campsites, developed day use sites and interpretive facilities would be available for public use. Stateline Recreation Site (lower bench area) would be closed to camping when Fishing Access 6 is available for development. Several newly constructed trails would be provided for additional non-motorized recreation opportunities primarily in Segment 2. No motorized tour routes or bridges would be provided. The bridge below J.C. Boyle dam would be open for non-motorized use. The overall recreation facility development scenario would provide a spectrum of recreation opportunities, from developed campgrounds to primitive campsites, and from semi-primitive motorized access to primitive non-motorized trails. However, under Alternative 3 the number of developed facilities would be reduced from Alternative 1. Management controls, regulations and patrols would remain present but at a reduced level to enhance solitude for most visitors. Public access to the planning area would be improved the least under this alternative, and have the greatest reduction in open roaded access. The greatest opportunity for solitude and more primitive recreation pursuits would be available under this alternative.

Recreation use such as fishing and camping will be expected to remain near the present level and increase slightly over time due to the limited road improvements and reduction in developed facilities. Kayaking opportunities would likely become available in segment 1 with increased/stabilized flows, however, whitewater boating use in Segment 2 and 3 would be expected to decrease over time if the amount of water releases is much below 1500cfs. This could impact the viability of commercial whitewater boating companies and commercial/ private passenger's ability to float the river. Some displacement of OHV visitors would be expected as roads and areas presently used are closed or rehabilitated. Additional firearm use restrictions in about one-half of the planning area would be implemented to protect visitors and property. Some opportunities for primitive (non-designated) camping and designated camping close to the river would be lost due to road or campsite closures or relocations.

The greatest amount of vegetation management (compared to the other alternatives) should sufficiently reduce fuel loadings and reduce the risk of catastrophic (forest stand replacing) wildfires. There would be additional short-term impacts from increased noise, dust and smoke from vegetation management and prescribed fire operations. Increased water quality and quantity would benefit the recreational experience, and stream restoration efforts may facilitate whitewater floating at lower water levels, after implementation. Livestock grazing would be greatly reduced in Alternative 3, benefiting those recreationists who find grazing objectionable.

Alternative 4

Scenery Management - See "Impacts Common to All Alternatives"

Recreation Facilities and Management - Alternative 4 provides the greatest amount of developed camping, day use, interpretive facilities and hiking trails of all the proposed

alternatives (see Map 16). This alternative would benefit those recreationists seeking a more structured, and/or less primitive, recreation experience. While opportunities for dispersed, more primitive recreation and solitude would be available, it would be the most limited under this alternative.

Many of these development proposals would be recommended for PacifiCorp lands, in Oregon and California. To achieve these developments, management agreements, BLM acquisition or PacifiCorp development would be necessary. In addition, it would be necessary to acquire funding or grants from PacifiCorp for increased law enforcement and for enhancing/developing recreation

This alternative also provides the greatest amount of Off-highway vehicle (OHV) opportunities or maintained roads. OHV tour routes would be on existing (but greatly improved) roads and designated, signed and have informational brochures to provide scenic tour opportunities for users. This would improve management of existing OHV use, through information/education efforts while improving protection of resource values associated with these routes. New vehicle bridges would greatly expand motorized loop tour opportunities. New tour routes would be provided, primarily in Segment 3 in California (PacifiCorp lands not currently open) assuming management agreements or BLM acquisition were completed.

While motorized travel on designated tour routes is expected to increase over the present, long-term resource damage to roads and other resources is expected to decrease, due to better road management, educational and partnership efforts. Additional law enforcement patrols, recreation site caretakers, along with educational efforts, would be provided to reduce vandalism and increase compliance with regulations.

Opportunities for unregulated target shooting and varmint hunting would be restricted during the summer season. While this management action would displace this activity to areas outside of camping and visitor use areas during a portion of the year, visitor safety would be significantly improved. Additional areas for target shooting and hunting would be available on non-motorized access only on Segment 3 (California) PacifiCorp lands, assuming management agreements or BLM acquisition was pursued. This would be a long-term benefit for hunters, as these areas are presently closed to public access.

Fishing access, especially in Segment 1, would be greatly improved. Like Alternative 2, several new fishing access trails and parking areas would be provided. In addition, a fishing access platform, expanded fishing trail, and improved parking areas are proposed for Segment 1. In Segment 2, additional new trail access would also be provided (compared with Alternative 2). Accessibility to those with disabilities would be the most enhanced under this alternative, and would be available at several sites in Segment 1, 2 and 3 (presently available at one site each in Segments 1 and 2 only). Some primitive, non-developed fishing access opportunities would be eliminated under this alternative. Some opportunities for solitude would be permanently lost.

A wide variety of camping opportunities would be available/provided. Fully developed campgrounds, with on-site caretakers would continue to be available, including new campgrounds in Segment 1 (Big Bend Park) Segment 2 (Powerhouse site), and Segment 3, (Shovel Creek site on PacifiCorp lands). The Klamath River campground in Segment 2 would be greatly expanded and upgraded, and would become a fee site. New and additional facilities would be provided and some existing facilities would be relocated in Segment 2 and 3, to reduce resource damage and provide for human waste containment. Non-motorized, dispersed camping would be reduced and in some cases eliminated in Segment 2. However, additional areas for dispersed camping would be available on some Segment 3 (California) PacifiCorp lands, assuming management agreements or BLM acquisition was completed. New group camping sites would be available in Segments 2 and 3. Campgrounds with RV hook-ups (water and power) could be available at Topsy campground and Shovel Creek site.

Several new trails, in addition to those proposed in Alternative 2, would be provided, greatly improving non-motorized recreation opportunities and access to remote areas. However, the Klamath River Edge trail from Frain Ranch (river right) to the Turtle camp area would be maintained for motorized travel, a loss to non-motorized recreationists. No dedicated non-motorized footbridges would be provided (bridges would be open to shared motorized and non-motorized use). Existing river rapid-scouting trails would be upgraded, improving boater safety.

Boating and kayaking river access would have the greatest improvements under Alternative 4. New facilities would be provided in Segment 1 (on PacifiCorp lands, assuming enhanced river flows), including a new kayak launch, parking area and restroom and improved in Segment 2 (Frain ranch, Caldera rapid and Tom Creek), and Segment 3 (Stateline and Fishing Access 6). Fishing Access 1, immediately outside the planning area would also provide improved boating access.

Improved road conditions and providing regular road maintenance would likely enhance commercial boating operations by improving access, passenger comfort and reducing vehicle breakdowns. Pursuing the timing of consistent river flows, to provide for mid-morning launches, would improve commercial boating marketability and viability while maintaining the Scenic River recreational ORV.

Motorized boating would be allowed under this alternative, for Segment 3 only. This is unlikely to affect recreationists in Segment 3, as motorized use would be expected to remain negligible and flow levels may be insufficient.

This alternative provides the greatest level of interpretive/environmental education efforts and developed day use facilities. These efforts would be designed to improve visitor information services, while increasing visitor compliance with rules and regulations and reducing vandalism and resource damage. Additional day use and scenic overlook sites would enhance the recreational experience by highlighting scenic vistas and educational opportunities.

Road Management - Road treatments designed to reduce erosion and vehicle rutting (through surface treatments) would help keep motorized travel on existing roads (and out of meadows). The availability of semi-primitive motorized tour routes would be most limited under this alternative. Main access routes would be greatly improved, allowing passenger type vehicle access. Several roads presently available for a semi-primitive motorized experience would be permanently improved, closed, seasonally closed and available for administrative access only, or converted to non-motorized trails. Compared to the other alternatives, Alternative 4 would provide the greatest improvement in motorized access (see Maps 20a and 20b). This would significantly increase motorized recreation use. It would also change the existing recreation management emphasis from semi-primitive motorized recreation opportunity spectrum (ROS) class to a roaded natural ROS class. This action would require an RMP amendment.

Road management, especially construction of new roads or closure/decommissioning of existing roads not only affects the miles of road open to vehicle travel, but also focuses recreation use. The majority of visitors traveling by vehicle tend to recreate a very short distance (often 1/4 mile or less) from where they park. To give an indication of the effect that road system management has on the amount of access, the area within 1/4 mile of each open road was calculated. For Alternative 4, about 508 acres would be accessible from motorized vehicles in Segment 1, 3,125 acres in Segment 2, and 2,014 acres in Segment 3 (refer to Table 5-1). Relative to Alternative 1, this alternative would entail a three percent reduction in motorized access in Segment 1, a less than one percent reduction in Segment 2, and a 37 percent increase in Segment 3.

Cultural Resource Management - See "Impacts Common to All Alternatives". In addition: Alternative 4 would provide the greatest enhancements of interpretation of cultural resources through displays, brochures and direct contact with recreationists. This would enhance the visitor experience and increase awareness to protecting these resources.

Vegetation Management - Alternative 4 would increase vegetative treatments compared to Alternative 1, especially around recreation sites and to enhance important wildlife habitat. (see Map 24). This would provide additional protection around recreation use areas by reducing fuel loadings and thereby reduce the risk for a catastrophic wildfire to occur. A catastrophic wildfire would cause a long-term negative impact to recreationists through a drastic reduction in vegetative diversity and scenic quality, and through the loss of recreation sites, use areas and opportunities.

Terrestrial Species/Habitat Management - Alternative 4 would have the greatest positive benefit to recreation users as it would highlight Watchable Wildlife around recreation sites and use areas. Management actions would enhance structures and habitat for viewing game and other desirable species. This would benefit recreation users by enhancing the quality of recreation experience.

Watershed Management Actions - Pursuing increased water flows for the Bypass Reach (Segment 1) on weekends during spring through fall, and increased instream flows for fish habitat and passage at other times would greatly enhance kayaking and boating opportunities. This would lead to increased whitewater boating use for the Bypass Reach (where there is presently a miniscule amount). This whitewater use would be managed to maintain a roaded natural recreation experience (see Appendix H, Recreation, Private Boating; and Commercial Boating for management recommendations). Continuing to pursue the pending water rights claim for 1500cfs during the primary whitewater use period would maintain the Scenic River recreation value (Segment 2).

The closure of roads parallel to the river or streams should have minimal impact on most motorized recreation access (see Map 20a). Many of these road closures are proposed where road access is duplicated or available nearby. The installation of fencing and barriers to prevent access across wet meadows would have a minor long-term negative affect on those OHV enthusiasts that enjoy driving across meadows. These enthusiasts would likely seek out other nearby unregulated areas with similar qualities.

Aquatic Species/Habitat Management - Alternative 4 provides the greatest enhancements for improving recreational fishing opportunities (see Map 28). Fish habitat and passage improvements through riparian/vegetation treatments, structural changes and channelization efforts, should positively affect recreational fishing opportunities by increasing numbers and sizes of resident fish. Providing for enhanced fish passage at J.C. Boyle dam should improve fishing opportunities by enhancing the ability of native fish to migrate. Enhancements at the J.C. Boyle fish ladder should increase opportunities for viewing fish and interpretation of fish migration patterns. Removal of sidecast material along the Bypass reach affected by the canal would enhance the creation of a hiking trail and fishing access along this reach. Channel width treatments would enhance whitewater boating (by creating additional, deeper rapids), and recreational fishing (through the creation of additional deep pools).

Range Management - Alternative 4 would provide additional enhancement measures (such as fencing recreation sites) to reduce negative impacts if cattle grazing were to resume around recreation sites and use areas. This would provide a positive psychological benefit to those recreationists who find cattle grazing to be objectionable.

Fire and Fuels Management - Alternative 4 increases the use of prescribed fire and vegetative treatments as a management tool to reduce fuel loadings (compared to Alternative 1) around recreation sites and along roads. This would more likely achieve both short and long-term goals of reducing the chance of a catastrophic wildfire. By reducing the risk of a

catastrophic wildfire, scenic quality, the desired recreation experience and recreation sites would be maintained. However, under Alternative 4, there would be greater short-term negative impacts to recreation visitors. This is because there would be increased noise and dust from greater use of mechanical equipment in fuel treatment areas, and more smoke, blackened tree boles and dead brush from increased prescribed fire activities near recreation sites.

Cumulative Impacts - In Alternative 4, five developed campgrounds (Topsy, Klamath River, Turtle, Lower Frain and Shovel Creek) would be provided, and the largest increase in additional designated dispersed campsites and developed day use sites would be available for public use (compared to Alternative 1). Barrier free access to facilities and existing trails would be improved. The most new trails would be constructed (compared to the other alternatives) to provide additional non-motorized recreation opportunities, including providing fishing access to the entire length of Segment 1 (Bypass reach). Some primitive, difficult to use fishing access and solitude opportunities would be unavailable. New motorized accessible bridges would be provided near Frain Ranch and Shovel Creek. The greatest number of motorized tour routes would be identified, in conjunction with increased OHV and other educational efforts.

The overall recreation facility development scenario would provide a spectrum of recreation opportunities, from developed campgrounds and designated campsites, and from roaded natural motorized access to primitive non-motorized trails. Management controls, regulations and patrols (i.e., management setting) would be noticeable (at the highest level compared to the other alternatives) but would remain subtle to most visitors. This management setting may cause some recreationists to seek out more primitive or less structured areas. Public access to the planning area would receive the greatest improvement for safer travel, allowing access by passenger type vehicles in many areas. This would change the character or recreation opportunity setting from a semi-primitive motorized to a roaded natural experience, and would result in a need to amend the RMP. Visitation would be expected to significantly increase due to these road improvements. Several roads presently available for a semi-primitive motorized recreation experience would be unavailable under this alternative. Several opportunities for primitive (non-designated) camping would be lost due to road or campsite closures or improvements to existing campsites.

Recreation use such as fishing and camping will be expected to increase significantly over time due to extensive road improvements and developed facilities. Whitewater boating use would also be expected to increase over current levels, due to more consistent water releases providing for mid-morning launches. Kayaking and boating opportunities would be expected to improve with more consistent flows, especially for Segment 1. Motorized boating would be permanently unavailable in Segments 1 and 2, except under special use authorization, but would be available in Segment 3. Some displacement of OHV visitors and loss of OHV opportunities would be expected as roads and areas presently open are closed or rehabilitated. Additional firearm use restrictions in about one-half of the planning area would be implemented to protect visitors and property. Some opportunities for primitive (non-designated) camping would be lost due to road or campsite closures or improvements to existing campsites.

Increased vegetation management (compared with Alternative 1) would help to reduce fuel loadings and the risk of catastrophic (forest stand replacing) wildfires. There would be additional short-term impacts from increased noise, dust and smoke from vegetation management and prescribed fire operations. Increased water quality and quantity would benefit the recreational experience.

Irretrievable, Irreversible, and Unavoidable Adverse Impacts

For Segment 2 in Alternative 3, pursuing run-of-the-river flows below the J.C. Boyle powerhouse at a level considered unsafe for whitewater boating (<1,500 cfs), would reduce or eliminate the opportunity for summer whitewater boating. The river flow level may not maintain the Wild and Scenic River recreational ORV.

The current situation, with later than "traditional or historical" water releases, (as compared to prior to 1994, when the upper Klamath River received national wild and scenic river designation) may significantly impact the long-term viability of commercial whitewater boating. Flows for only boating trips past noon, would cause a decrease in whitewater boating launches and commercial boating revenues. This is caused by the reduced ability of companies to market or "sell" a trip due to the lateness of getting off the river and returning to a company's home base.

Roads to be permanently closed, rehabilitated, converted to non-motorized use or available for administrative use only would be an unavoidable loss of motorized recreation opportunities, including access to primitive camping and fishing sites. Because many roads currently open would be closed or eliminated, opportunities for relatively unrestricted OHV use would be irretrievably lost.

Many opportunities for maintaining and providing semi-primitive motorized recreation experiences would be irretrievably lost under Alternative 4. Several roads, including primary access routes and recreation facilities would be greatly improved or receive upgrades. This would allow access by low clearance vehicles such as passenger cars, likely increasing the number of visitors into the canyon. Several opportunities for more rugged and primitive road touring would be permanently lost. More primitive recreation facilities would be upgraded or replaced with ones that have a higher level of development.

Under Alternatives 2 and 4, increased law enforcement, ranger patrols and use restrictions may have an unavoidable adverse effect on those recreationists seeking a more primitive and less structured recreation experience. This may permanently displace and cause an adverse impact to these recreation users in other areas with less restrictions and patrols.

Under Alternative 3, reduced law enforcement, ranger patrols and use restrictions may have an unavoidable adverse effect on other recreationists, if lawlessness and vandalism continues and prevails. This may cause an unavoidable adverse impact by permanently displacing those recreation users seeking a safer, more structured environment to other areas with greater patrols and visitor contact.

Most designated developed camps and many opportunities for primitive (non-designated) camping would be irretrievably lost due to road or campsite closures under Alternative 3. This would displace those recreationists seeking a more primitive camping experience to other areas outside the river canyon, which would be an unavoidable adverse impact.

Some primitive (non-developed) fishing access opportunities would be permanently eliminated under some alternatives. With a loss of primitive access opportunity or if recreation use increases, some opportunities for solitude would be lost. These would be unavoidable impacts from proposed management actions. The continued use of the Klamath River Edge trail from Frain Ranch to the Turtle camp area for motorized access would be an unavoidable loss to non-motorized recreationists in Alternative 4.

Under Alternative 4, the greatest increase in recreation use would be expected. Greater crowding of fishing facilities, developing facilities where there is presently limited or no development, improved motorized access and greater visitor contact would likely change the character of the typical recreation experience in the canyon. The experience would no longer meet the criteria for the semi-primitive motorized recreation opportunity spectrum (ROS), likely becoming a roaded natural or rural classification. This would likely displace and negatively affect those recreationists who seek a more primitive recreation experience, and would be an irretrievable and unavoidable impact. It would also necessitate an RMP amendment.

Motorized boating would be permanently unavailable in all segments with Alternatives 2 and 3, except under special use authorization.

Table 5-1.—Area accessible by motor vehicle (acres) within the planning area[1]

	Alternative			
Segment	1	2	3	4
1	523	356	356	508
2	3,145	2,975	2,828	3,125
3	1,265	1,514	1,182	2,014
Total	4,933	4,845	4,366	5,647

[1] For this analysis of consequences, the extent of "motorized accessibility" for each alternative was calculated using geographic information system software by determining the area of land that is: (1) within 1/4 mile of an open or seasonally open road that is within the planning area; (2) on slopes less than 35 percent; and (3) on the same side of the river as the road that is within 1/4 mile, and not in the river itself.

Roads/Access

Assumptions

It is anticipated that road improvements (both spot and contiguous) would be maintained over time, in order to continue to achieve transportation management objectives.

Implementation of any road action proposed on private land or land managed by an agency other than the BLM will be contingent upon approval from the affected land owner or agency. Road actions that are linked to other proposed actions (i.e., "connected actions") will, when practicable, be sequenced so as not to cause undue reductions in access that would complicate implementation of the related project.

The potential for increased or more concentrated recreation use, and its potential to affect road maintenance needs, has been considered and addressed in the development of proposed road improvements.

For all alternatives, the approximately four miles of mapped roads that traverse private ranch and non-industrial timber land in Segment 3 of the planning area were considered to be only open for administrative access, that is, open only at the discretion of the landowner.

PacifiCorp Facilities - If PacifiCorp determines that some facilities or road right-of- ways are no longer needed, or if those facilities are affected by FERC relicensing in such a way that they are removed, the management objectives for roads used to access those facilities will be reevaluated.

Impacts Common to all Alternatives

Scenic, cultural, fisheries, range management, fuels management, and land tenure actions are not expected to have any effects on the road network.

Road Management Actions - In all alternatives, access to private land on existing rights of way will not be lost through BLM actions, although access points may change and, if affected owners are willing, some rights of way may be changed.

No Road Management Actions are recommenede for non-PacifiCorp private land. The BLM would cooperate with private landowners willing to implement Road Management Actions designed to improve watershed conditions.

Road obliteration is proposed under all alternatives and road decommissioning is proposed in Alternatives 2-4 (refer to Tables 5-3a and 5-3b). Chapter 4 describes the different practices to perform these road treatments.

The existing Pokegama Seasonal Closure will continue in all alternatives. In each alternative, the closure area includes 1.4 miles of road on private land. The extent of the closure will vary between alternatives, but no alternative would reduce the extent of the closure. Other road treatments planned within the closure vary by alternative and may include improvements, decommissioning, obliteration and construction.

It is recommended that two roads on PacifiCorp land in Segment 3 remain closed to public access, 1) the road that parallels the west side of the river, and, 2) the road that crosses the river near the mouth of Shovel Creek.

Vegetation Management - Depending on the alternative, proposed vegetation management actions could cause small increases in peak flows in small streams (refer to the Watershed Values - Tributary Streamflow discussion). Higher peak flows could overwhelm the capacity of culverts and other stream crossings, leading to diversion of flow paths onto roads and erosion of the road surface. The risk of this occurring as a result of proposed actions is low, and proposed stream crossing improvements would reduce the potential for this to occur.

Heavy vehicle traffic associated with vegetation treatments would have the potential to damage road surfaces or road drainage features. Were this to occur to a degree greater than expected, for the type of work being done, the damage would be repaired in a timely manner to ensure that more extensive damage does not result.

Where the construction of short access roads is required to implement vegetation management projects, there would be potential for unauthorized use of these roads and subsequent resource damage. In order to help prevent these impacts, any such roads would be obliterated as rapidly as possible according to existing RMP standards.

Watershed Management Actions - Stream crossing improvements (refer to Tables 5-2a and 5-2b) are included within all alternatives, though the number and type of crossings vary by alternative (refer to Table 4-8). Types of crossing improvements would include culvert installation or enlargement and placement of low water fords. By installing new crossings or replacing deteriorated crossings, these actions would ensure the long-term viability of the road network and reduce resource damage associated with the road network and traffic.

Impacts of Specific Alternatives

(Refer to Tables 4-8, 5-2a, 5-2b, 5-3a, 5-3b, 5-4; Maps 17a thru 20a, Maps 17b thru 20b; and Appendix H)

Alternative 1

Recreation Management - Since no actions to increase or concentrate recreation use are proposed, no additional impacts to the road network are anticipated (see Map 13).

Road Management -

BLM:

Segment 1: Spot improvements and more regular maintenance on the upper portion of the Topsy Road along Segment 1 would make this road easier and safer to drive and thereby provide better access into the planning area (see Map 17a).

Segment 2: In Segment 2, the 0.4 miles of road construction adjacent to the existing Chert Creek road (which is causing damage to the stream), would allow the existing road to be obliterated. Likewise, short spur roads constructed north of Frain Ranch would allow obliteration of the Old Homestead road (see Map 17a).

Obliteration of the road near Chert Creek, roads in T.40S, R.6E, Section 35, roads in the riparian reserves of the river, and the Salt Caves access road will reduce access to the river to a minor extent, but other roads provide similar access.

The existing seasonal Pokegama Closure and administrative closure of about 2.5 miles of powerline access roads would reduce the need for road surface maintenance, but would also reduce open road system mileage (refer to Table 5-4).

Spot improvements on roughly 2.5 miles of the Topsy Road that cross BLM land in Segment 2 would improve overall access to this part of the planning area.

Segment 3: In Segment 3 the Hessig Creek road, which passes through BLM land, would continue to be closed to public access in this alternative (see Map 17a).

PacifiCorp:

Segment 1: The short portion of Topsy road that passes though PacifiCorp land in the northeast corner of Segment 1, and the portion of the Powerhouse road that crosses PacifiCorp land would receive spot improvements. This would improve vehicle travel and access to the canyon, as well as to lands adjacent to the canyon.

Segment 2: In Segment 2 the construction of about one-third of a mile of road on PacifiCorp land (T.41S, R.5E, section 12, and T.41S, R.6E, section 7) would allow the existing road to be obliterated but maintain access to the area via other routes.

Obliterating more than a mile of roads in the vicinity of Frain Ranch and at the south end of the Klamath River Edge road will reduce access to the river to a minor extent, but other roads provide similar access. Continuation of the Pokegama Closure affects less than two miles of road on PacifiCorp lands. Administrative closure (gating) of powerline roads on PacifiCorp land would reduce road damage and long-term maintenance needs.

Segment 3: The more than nine miles of roads on PacifiCorp land that access irrigation diversions, rangelands, and timber stands in Segment 3 will remain closed to general public use in this alternative, thus reducing possible road damage and long-term maintenance needs. Spot improvements on about 0.5 miles of the Topsy Road as it passes through PacifiCorp land will improve overall access to the planning area.

State of Oregon:

About one-quarter of a mile of road on state land in Segment 2 would be recommended for administrative use closure in Alternative 1, which would affect public access only to a minor extent (see Map 17a).

USFS:

Short lengths of road that cross National Forest system lands in Segment 3, would continue to be closed to public access, as the roads that access them are gated where they intersect Topsy Road.

Cumulative Impacts - In this alternative, approximately 45 miles of road would be open for year-round public access and eight would be open for seasonal access (Refer to Table 5-4). The overall road system and safety to travelers would be improved with just under one mile of new road construction, just under five miles of road obliteration, and spot improvement on just under five miles of road (Refer to Tables 5-2a, 5-2b, 5-3a, 5-3b). Public access to the planning area would be improved, but some access within certain areas would be reduced, although similar access will remain with other existing roads.

Alternative 2

Recreation Management - Increased road maintenance would be required along access routes to newly built, expanded, or upgraded campgrounds and facilities, since recreation actions will likely lead to concentrated and perhaps increased use. Proposed road treatments (described below) will mitigate the impacts of increased traffic, as will the fact that most recreation use in the planning area occurs during the dry season, when roads are less prone to damage (see Map 14).

Road Management - Road treatments proposed in Alternative 2 are focused primarily on public and PacifiCorp lands in Segment 2, but would affect the road network and public access throughout the entire planning area (see Maps 17a thru 20a).

BLM:

Segment 1: A new, short (<0.1 miles) spur road would provide access to the proposed Big Bend recreation site.

Proposed spot improvements to the upper portion of the Powerhouse and Topsy Roads within and adjacent to Segment 1 would make these roads easier and safer to drive and thereby provide better access into the planning area.

Administrative use closure of a few short lengths (less than 0.5 miles total) of roads would reduce public access and would reduce maintenance needs and deterioration of the road surface.

Segment 2: A new bridge constructed across the river at the site of an old bridge north of Frain Ranch would expand public nonmotorized use on both sides of that portion of river. Construction of short spur roads to access recreation sites on both sides of the river (probably less than 0.1 miles each), will maintain access to popular dispersed camps while allowing other, longer roads to be obliterated.

Obliterating approximately seven miles of road in the Frain Ranch area, around Salt Caves, and near Chert Creek would decrease public access slightly. However, access to all these areas, except the river near Salt Caves, would still be available from other nearby roads.

Continuing the existing seasonal Pokegama Closure (7.5 miles of road in Segment 2 - 4.5 of which are on BLM land) and installing other administrative road closures (2.5 miles of powerline access roads) would reduce public access to a small extent, but also will reduce the need for road surface maintenance.

Spot improvements (proposed for more than six miles of the Powerhouse road, more than three miles of the Topsy Road, a short length of the Frain Ranch access road, a river access road on the north side of the river near the state line, and a native surface road near Hoover Ranch) will improve access along both sides of the river and also reduce resource damage caused directly by roads and road use. The improved road to Hoover Ranch would become the sole motorized access route to the area.

Segment 3: In Segment 3 the Hessig Creek road, which passes through BLM land, would continue to be closed to public access.

PacifiCorp:

Segment 1: Reconstructing the bridge immediately downstream from J.C. Boyle Dam would increase public and administrative access. New administrative use closures proposed for slightly more than a mile of roads that access PacifiCorp lands and facilities would reduce maintenance needs and deterioration of the road surface. Spot improvements to a short portion of Topsy Road and a portion of the Powerhouse Road would improve access to the canyon, as well as to lands adjacent to the canyon (see Map 18a).

Segment 2: Constructing a short (less than 0.3 miles) connecting road on the north end of Frain Ranch would allow obliteration of more than half a mile of road on PacifiCorp land, as well as a portion of road on adjacent BLM land.

Obliteration of more than half a mile of road on the north end of Frain Ranch, nearly 3 miles of road in riparian reserves in the vicinity of Frain Ranch, short lengths of spur roads near Caldera Rapid, and many other user-created roads in the southern portion of the Frain Ranch area outside of riparian reserves would decrease motorized travel on PacifiCorp lands.

Limited administrative use closures of powerline roads west of the river and two miles of road in the Pokegama Closure would decrease public access, but would reduce road damage and long-term maintenance needs.

Limited spot improvements on the segment of the Powerhouse road east of the Hells Corner overlook, as well as spot resurfacing on the Topsy Road, would improve public safety of the roads.

Segment 3: New roads near the Beswick Hot Springs will provide access to the proposed Shovel Creek campground and day use area but would not substantially expand the transportation system.

Implementing administrative use closures on the upper portion of the Negro Creek road, as well as associated spur roads, would eliminate public motorized access to low voltage powerlines that cross the drainage.

Permitted public use (a type of administrative use) proposed on about 2.5 miles of road to the south of the river would expand available road travel options near Shovel Creek and up to the panther Canyon Overlook. Public use on these roads would be permitted only when the roads were dry enough to avoid being damaged, and portions of these roads would be improved to reduce erosion and road-surface damage. The road leading to Access 6 would also be improved to allow easier access by vehicles towing trailers.

State of Oregon:

Segment 2: Less than 0.3 miles of obliteration recommended for a road on state forest land would not substantially affect access to those lands, as other roads provide access (see Map 18a).

Administrtative use closures recommended for about three-quarters of a mile or roads on state land would reduce public access while retaining land owner access.

USFS:

Segment 3: Short lengths of road that cross National Forest system lands would continue to be closed to public access, as the roads that access them are gated where they join Topsy Road.

Watershed Management Actions - Proposed reductions in the use of irrigation diversions in the Shovel Creek drainage would reduce the amount of water that passes over or adjacent to the lower portion of the Shovel Creek road. This would reduce puddling on the road surface.

Cumulative Impacts - In this alternative, approximately 36 miles of road would be open for year-round public access, seven would be open for seasonal access, and 16 would be available for administrative or permitted public use (see Tables 5-2a, 5-2b, 5-3a, 5-3b, 5-4). A total of slightly more than one mile of new road would be constructed, almost two miles of road would be decommissioned, about 10 miles would be obliterated, and over 18 miles of road would be improved. Decommissioning of short spur or connector roads on BLM and other lands would eliminate the opportunity for motorized access to a relatively small portion of the total area. Overall, the transportation system will be improved for safer travel, but there will be a 16 percent reduction in open road mileage (refer to Table 5-4).

Alternative 3

Road Management - Road management actions proposed in this alternative focus primarily on restoring natural processes and systems and reducing motorized access. Projects designed to improve road surfaces are less common in Alternative 3 than in Alternatives 2 and 4, while the extent of decommissioning and new closures is the highest of all alternatives (see Maps 18a thru 20a).

BLM:

Segment 1: Designating nearly two miles of hydropower facility access roads as administrative use only would reduce public access and maintenance needs, but would not affect the operation of the J.C. Boyle facilities.

Spot improvements implemented on the portions of the Powerhouse road and Topsy road designed to reduce road-related damage to natural resources, would also improve safety and ease of travel.

Segment 2: Construction of about 0.2 miles of road would occur on BLM in order to maintain motorized access to the Klamath River Campground when the existing spur road leading into this site is obliterated.

Road obliteration (more than seven miles, including the full length of the existing Klamath River Campground spur road), decommissioning (short spur roads), seasonal closures (10 miles of BLM road within the Pokegama Seasonal Closure - which would be expanded in this alternative), and administrative use closures (almost four miles, focused on the powerline access roads near the Klamath River Campground and Old Homestead road north of Frain Ranch), would significantly reduce the amount of open roads in this segment of the planning area.

Road improvements in Alternative 3 are less extensive than in Alternatives 2 and 4, and would focus on improving travel on the Topsy Road and on the Hoover Ranch access road.

Segment 3: The lower portion of the access road to the Stateline recreation site would be obliterated (contingent on the relocation of that recreation site). Access to the campgrounds on the upper bench would not be affected.

The Hessig Creek road, which passes through BLM land, would also be decommissioned in this alternative.

PacifiCorp:

Segment 1: The recommendation to close nearly two miles of access roads on PacifiCorp land to public use would reduce damage to adjacent resources and maintenance needs on

those roads. Public motorized access to the fish ladder area and the bridge site immediately downstream from J.C. Boyle dam will be removed by these actions.

Spot improvements to short portions of the Topsy Road and Powerhouse Road that pass though PacifiCorp land in Segment 1 would improve access to the canyon, as well as to lands adjacent to the canyon.

Segment 2: Construction of a short (less than 0.3 miles) connecting road on the north end of Frain Ranch would slightly add to the road system, but would allow obliteration of more than half a mile of road on PacifiCorp land, as well as a portion of road on adjacent BLM land.

Obliteration of more than fivemiles of road (primarily at Frain Ranch on both sides of the river and also near Chert Creek), limited road decommissioning near Caldera rapid, limited administrative use closures (powerline roads), and continuation of the seasonal Pokegama Closure (less than two miles of road) would reduce public access, as well as road damage and long-term maintenance needs.

Limited spot improvements, including minor road widening on the Powerhouse Road and the Topsy Road, would improve the safety of the roads, but would require increased maintenance. Resurfacing the Powerhouse Road where it crosses Chert Creek meadow will substantially prolong the length of time this road can be used without causing resource damage.

Segment 3: Obliteration of the lower portion of the road to Stateline recreation site (contingent on the relocation of that recreation site), and the decommissioning Hessig Creek road would reduce administrative access to areas of BLM and PacifiCorp land, and would also make access to adjacent private land more inconvenient.

It is recommended that the entire length of the Shovel Creek road would be open only for administrative use, and some spurs off that road could be obliterated.

Approximately four miles of roads on both sides of the river that access PacifiCorp ranch and forest lands and adjacent public lands. Portions of these roads would be improved to reduce erosion and road-surface damage. These actions would also result in improved administrative access. Improvement of the road leading to Access 6 would allow safer travel, especially by vehicles with trailers.

State of Oregon:

Segment 2: Effects to motorized access on state land in Segment 2 in this alternative do not differ greatly from those of Alternative 2. Road obliteration recommended for short segments of road on state forest land (0.4 miles) would cause slight reductions in access.

Access on about three-quarters of a mile of roads on state land would be reduced as a result of the recommended administrative use closure.

USFS:

Segment 3: Short lengths of road that cross National Forest system lands would continue to be closed to public access, as the roads that access them are gated where they join Topsy Road.

Watershed Management Actions - Proposed reductions in the use of irrigation diversions in the Shovel Creek drainage would reduce the amount of water that passes over or adjacent to the lower portion of the Shovel Creek road. This would reduce puddling on the road surface.

Cumulative Impacts - In this alternative, approximately 22 miles of road would be open for year-round public access, 23 miles would be closed to public access, and another 15 would be

open for seasonal access (see Table 5-4). Less than one mile of new roads would be constructed, three miles would be decommissioned, 10 miles of road would be obliterated, 23 miles would be closed to public access, and about 13 miles of road would be improved. A small portion of the transportation system will be improved to safer travel, but there will be a substantial reduction in open roads (refer to Tables 5-2a, 5-2b, 5-3a, 5-3b, 5-4, and Maps 19a and 19b).

Alternative 4

Recreation Management - Increased road maintenance would be required along access routes to newly built, expanded, or upgraded campgrounds and facilities, since these actions will likely lead to concentrated, and perhaps increased, use. Proposed road treatments (described below) will mitigate the impacts of increased traffic, as will the fact that most recreation use in the planning area occurs during the dry season, when roads are less prone to damage (see Map16).

Road Management - Road management actions in this alternative provide access and opportunities for a range of recreation activities while ensuring that increased use of roads and improved motorized access does not have excessive impacts on natural resources (see Maps 20a and 20b).

BLM:

Segment 1: Resurfacing ("contiguous improvement") of portions of the Powerhouse and Topsy Roads on BLM land would ensure that convenient recreation access is available and that roads experiencing increased use would not deteriorate as a result.

Segment 2: A new bridge across the river would be constructed at the site of an old bridge north of Frain Ranch. This bridge would be open for public motorized use, and will provide more convenient access for day use and overnight trips, as well enabling better management of recreation sites on both sides of that portion of river.

The 0.5 miles of new road built adjacent to the existing Chert Creek road (which would be obliterated) and short spur roads built north and west of Frain Ranch will maintain access to popular recreation sites.

Decommissioning of roads (about 0.3 miles, focused in riparian reserves of the river and tributary streams, the Frain Ranch area, and the Salt Caves area) would eliminate motorized access opportunities in a relatively small portion of Segment 2. Access to the areas along these roads would still be available from other nearby roads.

About 5.5 miles of road on BLM land would continue to be affected by the Pokegama seasonal closure. Another mile of roads on BLM land will be open only for administrative access, which may make access to one parcel of private land in California more inconvenient.

More than 13 miles of road on BLM land would be improved in this alternative, slightly more than is proposed in Alternative 2. Road improvements (including resurfacing, widening, and installation of pull-outs) and minor realignments on the Topsy Road will make the road more accessible for low-clearance vehicles for its entire length in Oregon and subsequently increase driver safety and ease of travel. The Powerhouse Road would be improved to similar standards from the J.C. Boyle Powerhouse to the Caldera Rapid overlook. From the Caldera Rapid overlook to the Hells Corner overlook, the road would be maintained at lower standards, although maintenance would be more frequent than at present. The Klamath River Campground spur road, a short section of the Frain Ranch access road, the Tom Substation river access road, and portions of the Klamath River Edge road would also be improved, resulting in better travel conditions.

Segment 3: The Hessig Creek road, which passes through BLM land, would continue to be closed to public access in this alternative.

PacifiCorp:

Segment 1: Reconstructing the bridge immediately downstream from J.C. Boyle Dam would increase public and administrative access through Segment 1. The roads leading to the proposed bridge site are in good condition on both sides of the river, so no improvement beyond the current maintenance program is expected to be required (see Map 20a).

About one-half mile of native surface roads that provide access to a portion of the flume would be closed to public access.

The portion of the Powerhouse Road that is located on PacifiCorp land would be resurfaced and would provide safer more convenient travel.

Segment 2: About one-third of a mile of new road recommended for construction on PacifiCorp land adjacent to Chert Creek (extending onto BLM as well), would replace the existing Chert Creek road and thereby maintain a secondary motorized access route to the Hoover Ranch area (see Map 20a).

The recommended obliteration of slightly more than two miles of road on PacifiCorp land (including the existing Chert Creek road, one mile of excess roads in the vicinity of Frain Ranch, and the Klamath River Edge road) would reduce overall motorized access within the canyon.

Two miles of road that are on PacifiCorp land will continue to be affected by the Pokegama seasonal closure.

Road improvements would provide safer travel on about 2.5 miles of PacifiCorp road, primarily along the Powerhouse and Topsy Roads.

Segment 3: Recommended new roads built on PacifiCorp land near the Beswick Hot Springs would provide needed access to the proposed Shovel Creek campground and day use area but would not add significantly to the transportation system (see Map 16).

Public use would be allowed on about 2.5 miles of road to the south of the river when the roads were dry enough to avoid being damaged. This change in road status would add substantially to the open road system in this segment.

Extensive improvements would occur on the road leading to Access 6 to facilitate safer and easier use by vehicles pulling trailers.

USFS:

Segment 3: Short lengths of road that cross National Forest system lands would continue to be closed to public access, as the roads that access them are gated where they intersect Topsy Road.

Watershed Management Actions - Stream crossing improvements are proposed at seven sites. Although these crossings currently do not pose risks to the road network, some puddling does occur on the Powerhouse road and the Frain Ranch access road. By installing culverts at such sites, the proposed actions would eliminate standing water on road surfaces.

Cumulative Impacts - In this alternative, approximately 49 miles of road would be open for year-round public access, and 10 would be open for seasonal access. Less than two miles of new roads would be constructed, less than one mile of road would be decommissioned, about six miles would be obliterated, and about 22 miles of road would be improved. Overall a large portion of the transportation system will be improved for safer travel and there would be

a slight increase in open road mileage as compared to the other alternatives (refer to Tables 5-2a, 5-2b, 5-3a, 5-3b, 5-4, and Maps 17a thru 20a).

Irretrievable, Irreversible, and Unavoidable Adverse Impacts

For all alternatives, an irretrievable loss in road use opportunities would occur during the time that roads are seasonally or permanently closed (see Maps 17b thru 20b). Unavoidable short-term impacts (inconvenience) to vehicle travelers on roads in and adjacent to the planning area would occur during road construction and improvement activities. The current situation, with later than "traditional or historical" water releases, (as compared to prior to 1994, when the upper Klamath River received national wild and scenic river designation) may significantly impact the long-term viability of commercial whitewater boating. Later than "traditional or historical" water releases, much past 12 noon, would cause a decrease in whitewater boating launches and commercial boating revenues. This is caused by the reduced ability of companies to market or "sell" a trip due to the lateness of getting off the river and returning to a company's home base. This drop in commercial use would also reduce the BLM's ability to generate special recreation use fees, which are based on commercial boating use gross revenues. These fees are returned to the area and used by the BLM for visitor contact and maintenance.

Table 5-2a.—Proposed/recommended road improvements, by segment (miles)

	Alternative			
	1	2	3	4
Segment 1				
Spot	0.6	4.4	4.4	–
Contiguous	–	–	–	4.4
Segment 2				
Spot	4.3	10.1	3.3	3.1
Contiguous	–	1.6	0.7	9.8
Segment 3				
Spot	–	2.3	1.7	2.3
Contiguous	–	0.1	0.1	0.1
Total				
Spot	4.9	16.8	9.6	5.4
Contiguous	–	1.7	0.8	14.3
Net Impact				
Miles	4.9	18.5	10.4	19.7
Percent of open road network affected[1]	8%	31%	17%	29%

[1] Calculated as the percent of roads (not including roads that are proposed for decommissioning or obliteration) within each alternative that would be improved.

Table 5-2b.—Proposed/recommended road improvements, by ownership (miles)

	Alternative			
	1	2	3	4
BLM				
Spot	3.6	12.3	6.3	1.8
Contiguous	–	0.9	0.4	11.9
PacifiCorp				
Spot	1.0	4.4	3.1	3.5
Contiguous	–	0.8	0.4	2.3
State of Oregon				
Spot	0.3	–	–	–
Total				
Spot	4.9	16.8	9.6	5.4
Contiguous	–	1.7	0.8	14.3

Table 5-3a.–Proposed BLM and recommended PacifiCorp road construction, decommissioning, and obliteration, by segment (miles)

	Alternative			
	1	2	3	4
Segment 1				
Construction	–	0.1	–	0.1
Segment 2				
Construction	0.9	0.2	0.3	1.0
Decommissioning	–	1.9	1.0	0.3
Obliteration	4.9	9.2	12.6	5.6
Segment 3				
Construction	–	0.8	0.3	0.5
Decommissioning	–	–	2.1	–
Obliteration	–	0.5	0.7	0.1
Total				
Construction	0.9	1.1	0.6	1.6
Decommissioning	–	1.9	3.1	0.3
Obliteration	4.9	9.7	13.3	5.7
Net impact				
Miles	-4.9	-10.5	-15.8	-4.4
Percent of existing road Network	-6%	-15%	-21%	-7%

Table 5-3b.–Proposed BLM and recommended PacifiCorp road construction, decommissioning, and obliteration, by ownership (miles)

	Alternative			
	1	2	3	4
BLM				
Construction	0.4	0.2	0.2	0.5
Decommissioning	–	1.6	1.6	<0.1
Obliteration	3.5	4.8	7.7	3.5
PacifiCorp				
Construction	0.5	0.9	0.4	1.0
Decommissioning	–	0.4	1.5	0.3
Obliteration	1.4	4.6	5.3	2.2
State of Oregon				
Obliteration	–	0.3	0.3	–
Total				
Construction	0.9	1.1	0.6	1.6
Decommissioning	–	1.9	3.1	0.3
Obliteration	4.9	9.7	13.3	5.7

Table 5-4.–Proposed BLM and recommended PacifiCorp road status[1] designation, by segment (miles)

	Alternative			
	1	2	3	4
Segment 1				
Open	10.6	8.2	5.6	10.1
Admin. Use	–	2.4	5.0	0.5
Segment 2				
Open	26.6	19.9	8.5	27.8
Seasonal Closure	8.3	7.4	15.1	9.2
Admin. Use	4.6	4.8	5.9	1.2
Segment 3 [2]				
Open	7.3	7.4	7.8	8.0
Seasonal Closure	–	–	–	0.5
Admin. Use	5.6	8.8	12.3	10.1
Planning Area				
Open	44.5	35.5	21.9	45.9
Seasonal Closure	8.3	7.4	15.1	9.7
Admin. Use	10.2	16.0	23.2	11.8
Total roads available for some level of motorized access	63.1	58.9	60.2	67.4
percent of existing roads	94%	84%	78%	93%

[1] This table refers only to those roads that are open to public and/or administrative access for at least part of each year.
[2] With the exception of Topsy Road, roads on non-PacifiCorp private land in Segment 3 were assumed to be closed to use by the general public.

Cultural Resources and Native American Traditional Use

Assumptions

Natural processes and human activity impact cultural resources. Natural processes, such as wildfire, earthquakes, and erosion, can cause permanent negative impacts. Many of these impacts are unavoidable, however, some can be reduced. For example, fuel treatments can reduce the effects of catastrophic fires or bank stabilization measures can slow down the effects of erosion.

Potential for negative impacts to cultural resources caused by human activity will vary by degree and location of ground disturbing activities permitted under each alternative. Activities, such as construction of recreation sites or oak thinnings, have the potential for irreversible impacts, however, those impacts can be reduced through cultural resource surveys and mitigation measures mandated by sections 106 and 110 of the National Historic Preservation Act of 1966, as amended through 1992 (NHPA). Section 106 of the NHPA requires all federal agencies to "take into account the effect of the undertaking on any" cultural resource. Section 110 establishes the National Register of Historic Places, a program that ensures that historic properties are identified, evaluated, and nominated to the National Register, a roster of historic properties maintained by the National Park Service. Site protection, investigation, and interpretation would be similar under all alternatives.

Positive impacts occur when management actions decrease existing or potential site disturbance, such as closing areas off to public use or supporting educational programs. Project designs can be modified to avoid potential direct impacts to sites.

Currently, Klamath Falls Resource Area does not perform sub-surface sampling or testing methods as part of cultural resource surveys, thus covered cultural sites, such as lithic scatters, may be missed due to heavy organic ground cover. These buried sites are in danger of being negatively impacted by project activities. However, if cultural resources are encountered during proposed project activities, then all work would stop and the lead area archaeologist would be notified. Upon notification, the archaeologist would conduct an investigation and develop a plan (with consultation as necessary) to mitigate the situation.

Many of the projects are proposed on PacifiCorp lands and the implementation of these projects depends on PacifiCorp's own actions, agreements, or eventual land acquisitions. The nature of the impacts on cultural resources explored in this chapter are the same for all proposed projects whether the project is on PacifiCorp or BLM lands. Should adjacent PacifiCorp lands later be included within proposed projects where federal money is appropriated, then cultural resource surveys would need to be performed on the PacifiCorp lands prior to project implementation.

Impacts Common to All Alternatives

Scenery Management - Scenic values would be enhanced by supplementing fuel treatments with vegetation screening treatments. Using vegetation to screen facilities serves to protect cultural resources because it hides the resources from view. The use of fuel treatments, to meet long-term scenic quality objectives as described in the Fire and Fuels section, can have both a negative effect because it removes vegetative cover that serves to hide the resources from view, and a positive effect because it reduces wildfire temperatures which may cause damage to lithic materials.

Recreation Management - *Recreational trails (motorized and nonmotorized):* Trails can provide access into otherwise inaccessible areas. This exposes cultural resources to vandalism and theft. However, access also provides opportunities to experience the rich history of the area and to gather Ethnobotanical resources.

Dispersed and developed recreational sites (proposed and enhancement of existing facilities): There is direct conflict between recreation use and the protection of cultural resources at some locations. Mitigation helps reduce impacts, but impacts would continue to occur. Recreation opportunity draws people, which, can lead to at the very least, unintentional damage, such as people picking up pretty rocks, which happen to be artifacts, and increased soil compaction caused by increased foot traffic. Improved toilet facilities benefit cultural resources because they concentrate foot traffic and discourage random defecation. Dispersed camping increases damage to cultural resources because recreationists are dispersed throughout the canyon among cultural sites. Campground improvement and development of designated dispersed camping sites focus recreational use into designated areas that avoid cultural sites.

Interpretive/environmental education projects: Interpretive projects provide the public with knowledge of the canyon. Knowledge spurs respect for all the resources, including cultural. When people know that such resources exist in the area, they tend to treat those resources with respect when they encounter them. Unfortunately, knowledge can also spur contempt and greed, which can lead to an increase in intentional damage and looting. Overall, it is expected that interpretation will benefit cultural resource management.

Firearm use: People tend to use historic features for target practice, which can cause considerable damage. Repairing bullet damage can be costly. Materials used in the original construction of structures may no longer exist or be readily available thus, firearm use can cause a negative impact to historical features.

Whitewater rafting (private and commercial): While on the water, rafting does not affect cultural resources. However, rafts can penetrate areas that have little or no access. Resource damage can occur when the rafts stop along the shorelines. People may explore the landscape during a lunch stop and "discover" a cultural resource site. This can cause direct impact to the cultural context of a site as people intentionally pick up artifacts and kick at the ground looking for more. Unintentional impacts occur when rafters are unaware of the existence of a cultural resource. For example, they may build a campfire ring out of rocks originally used to construct a prehistoric feature.

Motorized watercraft use: Motorized watercraft is prohibited in Segments 1 and 2 in all the alternatives, In Segment 3 it is allowed in Alternative 4 and only by special use authorization in Alternatives 2and 3. The same concerns surrounding whitewater rafting apply to the use of motorized watercraft, if visitors stop and explore the shorelines.

Road Management (decommissioning, maintenance, obliteration) - The Road network channels human pressure into certain regulated areas, reducing human pressure in less accessible areas, which can positively impact cultural resources. Spot improvements and maintenance of roads positively affect cultural resources by reducing runoff erosion and gullying. In addition, decommissioning roads has a positive impact because it decreases access and potential disturbance to cultural resources. On the other hand, decommissioning roads can be negative because it reduces Native American access to culturally significant areas.

Cultural Resource Management - *Prehistoric site management:* Pursuing a nomination to add the canyon onto the National Register of Historical Places and developing a monitoring program is proposed in all alternatives. The value of having the canyon on the National Register would be that the area has national recognition and can be considered in planning for federal or federally assisted projects, and qualifies for federal assistance for historic preservation when funds are available. A monitoring program would encourage cooperative

working relationships between the federal government and outside groups. Cooperating groups would ensure the protection of cultural sites by implementing a plan designed to evaluate the effectiveness of mitigation strategies and document any disturbances based on frequent visitations to sites.

Historic site management: In all alternatives, the information that historic structures hold would be collected through extensive documentation. The documentation procedure would incorporate more then recording the site on State Historic Preservation Office (SHPO) site forms and mapping the site's location. Documentation would include a historic document review, which is defined as a study of published and unpublished documents, records, files, registers, and other sources, resulting in an analysis and synthesis of all reasonably available data. While this action would not protect the site from further deterioration, it would assure that valuable information is collected that can help with interpreting the history of the canyon.

Native American traditional use management: An Ethnobotanical study is proposed from J.C. Boyle Dam to Copco Reservoir. An Ethnobotanical study would inventory known information concerning culturally important plants and their locations in the canyon. The process would include a complete literature search and Native American interviews. Although this information would not be published for public distribution, it would help in the management of the canyon. The information would be used to avoid conflicts between proposed project development and Native American Traditional use areas. The information could be used to design vegetative treatments, such as mechanical thinning or prescribed burning, to control evasive plants and enhance Ethnobotanical resources. This knowledge could also effect road management decisions. Based on coordination and consultation efforts with local tribes, traditional use areas could be opened to ensure Tribal member access or closed to protect Ethnobotanical resources.

Terrestrial Species/Habitat Management - Proposed projects that would improve wildlife habitat include vegetation treatments, road decommissioning, and the creation of perches, roosts, and nest sites. Vegetation treatments focus on manually or mechanically thinning oak groves and brush fields, and manually or mechanically thinning around potential nest and roost trees. In addition to improving wildlife habitat, thinning oak groves decreases fuels (see the Fire and Fuels section in Impacts Common to all Alternatives for explanation) and most importantly encourages acorn growth. Acorns were and still are an important food staple for Native Americans in this area and are considered a culturally important resource (Holt 1946:308). However, oak thinning projects can have negative impacts to cultural resources if ground-disturbing equipment is used and the improved habitat draws feral pigs. Cultural resources sustain excessive damage when pigs root for food.

Perches, roosts, and nest sites can vary in shape and size. Creating perches and nesting sites can consist of modifying power poles, pruning branches, and topping/blasting treetops. Implementing fuel reduction or vegetation thinning projects could create roost areas. Nest boxes would be installed on old bridges or buildings. The installation of these devices can vary from drilling holes to strapping boxes on with bailing wire. Most of the buildings that occur in the canyon are considered historical resources. Mounting the perches and nest boxes to the historical buildings can cause minimal damage. However, damage could continue to occur as birds attracted to the nest boxes defecate, scratch, or excavate new cavities.

Watershed Management Actions - Riparian enhancement, meadow restoration, and sediment replenishment projects are proposed in all but Alternative 1. Actions (such as vegetation treatments, road decommissioning, and willow planting) would be designed to improve meadow and riparian conditions, which positively affects the Klamath River's fisheries and water quality. The river's water quality, especially in regard to fisheries, is an important aspect to local Native American cultures. Some view the fisheries as a Native American traditional property. Meadow and riparian improvements help reduce the effects of

erosion and encourage the growth of Ethnobotanically important plants. Plants such as reeds, willow, and cattail were used to make baskets and other utility items. Native Americans today continue to gather Ethnobotanical materials for food and crafts.

Stream/fisheries flows: Because the streambank is unstable and susceptible to extreme water flux and flooding due to PacifiCorp's operations, cultural resources located in these areas are under the threat of being eroded away.

Water attraction flow projects and large wood treatments are proposed in all the alternatives, to improve fisheries. Fisheries are an important cultural value to local Native American populations. Given that the anadromous fisheries have declined since the construction of Copco I Dam in 1917, this type of management could prove to have a neutral or beneficial effect. Because of the importance of the fisheries to local Native American cultures, this would be considered a positive affect on the fisheries as a cultural resource value.

Instream structures/irrigation diversions: To enhance the aquatic species habitat, fish ladders, reduction in the existing river channels, removal of old bridge abutments, and redesigning mainstream irrigation diversions in Segment 1 are proposed. Many of these projects are located along the streambank where cultural resources, such as habitation sites, basketry material gathering locations, and fish habitat exist. The short-term, ground-disturbing aspects of these projects can be mitigated to ensure that any cultural materials present are avoided. The long-term affects of these projects on cultural resources can be positive because they stabilize the riverbanks, reducing erosion effects on cultural sites, and improve fisheries habitat, which is a cultural value.

Range Management - Livestock congregation and trampling can negatively impact cultural resources (prehistoric sites or traditional uses), especially along fence lines and around water sources. In addition, the maintenance of existing fences and the possible construction of additional fences are ground disturbing activities that can impact cultural resources.

Fence maintenance and construction of new fences are proposed in all of the alternatives. A fence could impact a cultural site if materials from the site are used in the construction of the fence line. If the fence crosses a site, the holes dug to secure the fence posts can cause damage. Cattle and horses congregate and follow a fence line creating a trail that can compact or disturb the soils at a site. The weight of cows and horses on wet soils leave deep footprints. Artifacts may be stepped on by a cow or horse and broken. In addition, vegetation that once covered and hid a cultural site can be grazed down to bare earth by cows and horses. A fence can also have positive impacts. Fences can be routed around sites and designed to ensure that cows and/or horses (and sometimes people) will not enter a cultural site area.

Fire and Fuels Management - Fire and fuel treatments can have both a positive and negative effect on prehistoric resources. According to the Programmatic Agreement between the State Historic Preservation Officer (SHPO) and Oregon State BLM, the primary focus of concern for cultural resource surveys are the ground disturbing activities of fire suppression and/or containment such as building fire lines and landing sites. If these ground-disturbing activities are conducted through a site, the impacts are negative. In addition, fire and vegetative treatments, such as thinnings, remove vegetative cover. Vegetative cover hides the resources from vandalism and looting.

However, prescribed fire can have a positive affect on prehistoric resources. Excessive amounts of fuel cover can feed a wildfire, elevating the temperatures to the point that damages cultural resources. Prescribed fire temperatures can be controlled and maintained below 550 degrees Fahrenheit (300 degrees C). This is critical because the threshold temperature for creating mechanical and chemical changes for stone artifacts is 650 degrees Fahrenheit (350 degrees C). The threshold temperature for wood is 550 degrees Fahrenheit

(300 degrees C) for wood. The removal of overgrown, thick vegetation and ground cover through prescribed fire treatments can reduce the probability of a catastrophic fire event, that could cause damage to cultural resources especially around historic sites.

Ethnobotanical resources can benefit from fuel treatments. For example, Ipos (Perideridia sp.) root, an important Ethnobotanical plant is gathered in early spring (Spier 1930:164). Encroaching trees in a meadow full of Ipos could be cut back using mechanical thinning treatments or prescribed burn treatments. Such treatments open the meadow and encourage Ipos growth.

PacifiCorp Facilities - Maintenance of powerlines and other PacifiCorp facilities may cause direct negative impacts to cultural resources. Continued high flow releases from J.C. Boyle Powerhouse may cause streambank erosion, thus damaging cultural sites along the river.

Impacts of Specific Alternatives

(Refer to Maps 4, 13-16, 18a, 19a, 27, and Appendix H)

Alternative 1

Refer to Impacts Common to All Alternatives for discussions of actions to: Scenery Management, Road Management, Terrestrial Species/Habitat Management, Watershed Management, Range Management, Fire and Fuels Management and PacifiCorp Facilities. Other resource actions are discussed below.

Scenery Management - Refer to Impacts Common to All Alternatives section.

Recreation Management - For discussion related to: interpretive/environmental educational projects, Firearm use, Whitewater rafting, and Motorized watercraft use refer to Impacts Common to All Alternatives.

Recreation trails (motorized and nonmotorized): Under Alternative 1, only the maintenance of the Klamath River Edge Trail is proposed. No new trails would be constructed so no new potential impacts to cultural resources should occur. There would be no restrictions on non-motorized use, such as mountain biking, hiking, and horseback riding and motorized recreation is limited to designated roads on BLM land, but otherwise occurs unregulated therefore impacts to known and unknown sites may continue to occur.

Maintenance activities of the Klamath River Edge Trail and main road surfaces would have minimal to no impact to cultural resources because the actions would be mitigated. However, improvements to facilities tend to draw people to the canyon and increased human pressure can lead to both intentional damage, such as looting and vandalism, and unintentional damage to cultural resources. Implementing a no restriction policy can also lead to intentional and unintentional damage by allowing people to freely roam into areas where cultural resources may be located (see Map 13).

Dispersed and developed recreation sites (proposed and enhancement of existing facilities): Alternative 1 focuses on maintaining, enhancing, and monitoring the use of existing camping facilities. Proposed enhancement of Turtle Camp and Klamath River Campground involves the installation of barriers to define campsites. The barriers could consist of semi buried boulders to half buried posts. Although this activity is ground disturbing, the effect is minimal to cultural resources. Previous development of the campgrounds has disturbed the campground locations. If a buried site exists under the top soil horizon, it is possible that the holes dug for the barriers could be deep enough to damage the site's archaeological context. Existing recreation management agreements with PacifiCorp would continue.

Cultural Resource Management - *Prehistoric site management:* Sites will continue to be protected through pre-disturbance surveys, but both intentional and unintentional impacts are possible.

Historic site management: Historic structures are rapidly deteriorating in the canyon or have deteriorated past the point where preservation techniques would no longer be effective.

Native American traditional use management: Refer to Impacts Common to All Alternatives section.

Land Tenure - No changes are suggested in land tenure in Alternative 1 although both RMPs have an objective to acquire lands with the designated or suitable scenic river corridor (in river Segments 2 and 3) and in the designated ACEC in river Segment 2.. Thus there would be no additional effects on cultural resources.

Cumulative Impacts - The "No Action" Alternative 1 continues existing management activities. Adverse impacts associated with current activities would continue. However, the impacts would be minimized or avoided by conducting cultural resource surveys and enacting mitigation measures before any ground disturbing activities occur as mandated by Section 106 of the National Historic Preservation Act (NHPA).

Alternative 2

Refer to Impacts Common to All Alternatives for discussions of actions to: Scenery Management, Road Management, Terrestrial Species/Habitat Management , Watershed Management, Range Management, Fire and Fuels Management and PacifiCorp Facilities. Other resource actions are discussed below.

Recreation Management - Recreation trails (motorized and nonmotorized): The proposed Big Bend Fishing Access Trail would open up an area that is presently difficult to access due to the steep rocky slopes. Cultural sites presently located in hard to reach areas are currently protected only by their inaccessibility. Trails into these areas provide easier access, thus potentially exposing these sites to vandalism and looting. However, access also provides opportunities to experience the rich history of the area and, for Native Americans, to gather Ethnobotanical resources.

Although new trails open areas up to increased public use, converting old roads to trails, such as the road from Frain Ranch to below Spring Island, and closing trails to motorized vehicles, such as the Caldera Rapid area, can reduce impacts to cultural resources. These proposed restrictions reduce the number of people that use the area, which in turn, reduces the extent of vandalism and looting. These restrictions could also limit Native American access to Ethnobotanical resources, especially for the elderly who may have difficulty walking.

Motorized recreation would continue to be limited to designated roads. Maintenance of road surfaces would focus on reducing erosion impacts and improve safety and ease of travel. Erosion can negatively affect cultural resources by increasing deterioration and exposing artifacts and features. Thus any maintenance designed to reduce erosion impacts serves to positively affect cultural resources. Similar to trail improvements, any improvements to roads could potentially allow more people to visit areas that could have cultural sites.

Off-highway vehicle use would be limited to designated roads. This would positively benefit cultural resources because unregulated use leads to irreversible site disturbance. Off road riding may present more tempting challenges or thrills, but damage may occur at some cultural sites. Off-highway vehicle tires can cut deep into the soils, dispersing it, and compacting it. In addition, this type of disturbance increases erosion affects. OHV use also can produce excessive noise. Noise can negatively impact the use of Native American traditional use areas (see Map 14).

The construction of a non-motorized bridge is proposed at the old bridge site above Frain Ranch, below BLM campground. Re-establishing a bridge at this site would be beneficial for Native Americans desiring access to gather Ethnobotanical materials. However, the bridge would facilitate access to more area by the general public, thus intentional or unintentional damage could occur to cultural resources of all kinds.

Dispersed and developed recreational sites (proposed and enhancement of existing facilities): Alternative 2 focuses on enhancing and expanding existing camping facilities, and developing a few new camping facilities. Enhancement and expansion of facilities such as Topsy Reservoir campground, the Klamath River Campground, and Turtle Camp involves defining campsites by installing barriers, moving campsites, building campsites, and hardening campsites and parking areas. Although the installation of the barriers is a ground disturbing activity, the potential effect is minimal to cultural resources because the campground locations are previously disturbed areas due to past development of the campgrounds and heavy use of the areas. Hardening, such as laying gravel, in the developed campground areas can serve to protect any undetected buried cultural resources from soil compaction and artifact collecting (see Map 14).

Site improvements include designating group and individual campsites, hardening the parking area and boat ramp by laying rock, constructing permanent bathrooms, and constructing a non-motorized bridge. There is potential for direct conflicts between recreation use and the protection of cultural resources. Confining usage to specific locations helps to decrease impacts to the cultural resources by drawing people away from the resources. However, improved facilities attract increased usage, which can lead to unintentional damage, vandalism, soil compaction, and artifact collecting. Construction of a non-motorized bridge would provide access to the west side of the river. Access exposes previously undisturbed cultural resources to potential disturbance, yet provides Native Americans an opportunity to harvest Ethnobotanical materials.

Development of a Shovel Creek Campground on PacifiCorp land would increase human presence in the area. Increased human pressure generally leads to increased deterioration of cultural resources over the long-term.

Allowing dispersed camping, as proposed in some areas increases the potential for damage to cultural resources because recreationists are dispersed throughout the area where cultural sites may be located.

Interpretive/environmental education projects: Interpretive day-use displays are proposed at the Powerhouse site, Spring Island, Frain Ranch, Topsy Road portals, and Section 35 Overlook. In addition, interpretive brochures focused on Topsy Road and Off-Highway Vehicle (OHV) tour opportunities would be developed. Providing OHV users with tour opportunities helps to focus OHV impacts to designated roads and areas away from cultural resources (see Appendix H).

Firearm use: Refer to Impacts Common to All Alternatives section.

Whitewater rafting (private and commercial): Management actions would enhance whitewater opportunities in Alternative 2 by upgrading toilets at Spring Island; hardening parking and access to Tom Creek Substation, Hoover Ranch, and River Access #1; and developing a raft take-out at Fishing Access #6 on PacifiCorp land. Constructing toilets has a positive effect on cultural resources because it discourages random defecation, however, impacts to buried cultural resources could potentially occur during construction. Hardening parking and access areas focuses usage impacts to specific areas designed to avoid any cultural resources present and reduces erosion. Developing a raft take-out at Fishing Access #6 would increase the traffic in the area, but the project would decrease conflicts between recreation and cultural resources in other areas.

Motorized watercraft use: Refer to Impacts Common to All Alternatives section.

Road Management - Alternative 2 proposes to decommission several roads; implement spot improvements and maintenance; replace the J.C. Boyle Dam Bridge; and construct some new roads (see Map 18a).

The J.C. Boyle Dam Bridge is located in a very disturbed area. Replacing the bridge would have no effect on cultural resources.

The potential for adverse damage caused by the construction of new roads would be mitigated. During the planning process, proposed roads can be relocated or redesigned to avoid cultural resources. Construction would be monitored to ensure that no harm comes to any buried cultural materials not discovered during the initial surface survey. However, roads do provide access into hard to reach places. This increases the human traffic into such areas, which can lead to cultural resource damage.

Cultural Resource Management - *Prehistoric site management:* Prehistoric sites are fragile, nonrenewable resources that are rapidly disappearing. Alternative 2 emphasizes site preservation utilizing two techniques: site burial and access control. Site burial includes placing filter fabric over the site, covering with soil, and planting or seeding with native vegetation. The filter fabric serves to separate the cultural deposit from the fill material. The advantage of this technique would be to protect the site from further trampling, vandalism, and erosion.

Proposed fencing and roadblocks would control access. Fencing deters human and/or animal traffic and has a relatively low installation and maintenance cost. Potential impacts, although greatly reduced, could still occur because a fence can be climbed or cut by those who are bent on destruction.

Historic site management: Historic structures are rapidly deteriorating or have deteriorated past the point where preservation techniques are no longer effective. Alternative 2 focuses on stabilizing several historic structures that still stand in the canyon. These are Hoover 41 Ranch House, the Community Hall at the Beswick Complex, and the Truitt Saloon. Stabilization is defined as the practice of making a structure stable or structurally sound and minimizing its deterioration while preserving its current appearance. Stabilization has a positive affect on historic structures by reducing deterioration, so that the resource will be around for several more generations to learn from and enjoy.

In Alternative 2, a proposal to nominate the Topsy Road as a National Historic Trail is offered. National historic trails are recognized as important to American Culture in the National Trails System Act of 1968. The advantages of nominating the Topsy Road would be development, interpretation, stabilization, protection, and visitor use of the trail. Enhanced coordination and cooperation with landowners, other federal agencies and interested public would be possible, and cooperative management efforts could be funded through limited financial assistance that is available through this program.

Native American traditional use management: Refer to Impacts Common to All Alternatives section.

Land Tenure - Developing management agreements for, or the BLM acquisition of, PacifiCorp land would help facilitate protection for cultural resources and maintain the historic, prehistoric and traditional use values identified for the canyon. This alternative considers more land in California than Alternative 1 and proposes to include a portion of the Shovel Creek drainage. This alternative would have a more positive effect on the overall management of these resources than Alternative 1 because many known sites would be included.

Cumulative Impacts - The focus of Alternative 2 is to enhance opportunities and resources. Resulting impacts would be similar to Alternative 1, but the potential extent or degree of those impacts would increase. Mitigation measures would also be increased in this alternative with the resulting impacts from all management actions being minimal.

Alternative 3

Refer to Impacts Common to All Alternatives for discussions of actions to: Scenery Management, Road Management, Terrestrial Species/Habitat Management, Watershed Management, Range Management, Fire and Fuels Management and PacifiCorp Facilities. Other resource actions are discussed below.

Recreation Management - *Dispersed and developed recreational sites (proposed and enhancement of existing facilities):* Non-motorized camping and day use are encouraged in Alternative 3 (see Map 15). No new developed campgrounds are proposed. Some existing areas of dispersed camping would be closed to non-motorized access. Reducing the camping opportunities would be an overall benefit to cultural resources as compared to Alternatives 2 and 4. This would reduce or eliminate sources of ground disturbing activity, but some negative impacts could still occur. Cultural resources could continue to be impacted by vandalism and illegal artifact collecting.

Interpretive/environmental education projects: Refer to Impacts Common to All Alternatives section.

Firearm use: Refer to Impacts Common to All Alternatives section.

Whitewater rafting (private and commercial): Existing developed whitewater facilities would be maintained and primitive areas such as Hoover Ranch River Access would be closed or maintained for semi-primitive motorized river access. River Access #6 would be developed and the number of commercial trips per day and client limit would be reduced. All of these actions proposed in Alternative 3 would reduce rafting usage in the Canyon, which decreases potential impacts on cultural resources located along the river.

Motorized watercraft use: Refer to Impacts Common to All Alternatives section.

Road Management - Alternative 3 would result in less potential damage to sites because more road decommissioning, seasonal road closures, and enforcing regulated road use are improved (see Map 19a).

Cultural Resource Management - *Prehistoric site management:* Prehistoric sites are fragile, nonrenewable resources that are rapidly disappearing. Alternative 3 emphasizes site preservation by controlling access. Sites 35KL18, CA-sis-1721, and 35KL20 would be closed to motorized vehicles. Restricting access would reduce traffic in the area, which would greatly reduce unintentional disturbance, intentional vandalism, erosion, compaction, and illegal artifact collecting.

Historic site management: Historic structures are rapidly deteriorating or have deteriorated past the point where preservation techniques are no longer affective. Alternative 3 focuses on utilizing several techniques to preserve the historic structures that still stand in the canyon. These techniques are stabilization, with an emphasis on rehabilitation. Rehabilitation is defined as maintaining a structure as it currently exists and to protect it from deterioration. Stabilization is defined as the practice of making a structure stable or structurally sound and minimizing its deterioration while preserving its current appearance. Both techniques have a positive affect on historic structures. Although they can be costly, they reduce deterioration so that the resource will be around for several more generations to learn from and enjoy.

In Alternative 3, a proposal to nominate the Topsy Road as a National Historic Trail is offered (see Map 15). National historic trails are recognized as important to American Culture in the National Trails System Act of 1968. The advantages of nominating the Topsy Road would be development, interpretation, stabilization, protection, and visitor use of the trail. Enhanced coordination and cooperation with landowners, other federal agencies and interested public would be possible, and cooperative management efforts could be funded through limited financial assistance that is available through this program.

Native American traditional use management: Refer to Impacts Common to All Alternatives section.

In-stream structures/irrigation diversions: To enhance aquatic species habitat, some mainstream and tributary diversions would be recommended for removal in Alternative 3. Diversions are located along the riverbank where cultural resources exist and impacts could potentially occur. Although the area around the diversions was disturbed when the diversion was constructed, the short-term, ground-disturbing aspects of diversion removal can be mitigated to ensure that any cultural materials present are avoided. However, some of the diversions are cultural features, some were built by the Native Americans to harvest fish and later used by pioneers for irrigation. Removal of these cultural features would cause significant adverse impacts.

Terrestrial Species/Habitat Management - In Alternative 3, manual and mechanical vegetation treatments, removal of decayed nest boxes and an emphasis not to install new boxes are proposed. Removal of nest boxes and manual treatments would have no impact on cultural resources. Vegetative treatments, such as oak grove thinnings, would have a positive impact because the practice decreases fuels and encourages acorn growth, a culturally important plant (Holt 1946:308). However, the use of ground-disturbing equipment for mechanical vegetation treatments can negatively impact cultural resources, if no mitigation measures are taken. In addition, the improved habitat draws wild boars. Cultural resources sustain excessive damage when wild boars root for food.

Watershed Management Actions - *Stream/fisheries flows:* Alternative 3 provides several options for managing water attraction flows and promotes an extensive installation of large wood treatments. Depending upon which options are chosen, new structures would need to be constructed and/or old structures would need to be removed. These activities have the potential for causing extreme damage to cultural materials. However, most of the proposed actions are in areas of past disturbance. Disturbance of previously disturbed areas has no additional affect on cultural resources. Actions proposed in previously undisturbed areas would be surveyed, mitigated and monitored as needed. In addition, because these actions are designed to improve fish habitat, they would be viewed as having a positive effect on fisheries as a cultural resource. The Klamath River's fisheries, as a cultural resource, are important to local Native American populations.

In-stream structures/irrigation diversions: To enhance aquatic species habitat, some mainstream and tributary diversions would be recommended for removal in Alternative 3 (see Map 27). Diversions are located along the riverbank where cultural resources exist and impacts could potentially occur. Although the area around the diversions was disturbed when the diversion was constructed, the short-term, ground-disturbing aspects of diversion removal can be mitigated to ensure that additional damage to any cultural materials present are avoided.

Land Tenure - Developing management agreements for, or the BLM acquisition of, PacifiCorp land would help facilitate protection for cultural resources and maintain the historic, prehistoric and traditional use values identified for the canyon. This alternative is similar to Alternative 4 in that it proposes to develop management agreements for, or acquire all PacifiCorp land in the Planning Area.

Cumulative Impacts - Alternative 3 emphasizes natural resource enhancement and de-emphases human use. Although de-emphasizing human use in the canyon would promote protection for cultural resources, the potential for impacts still exists. Impacts would occur to a lesser degree than described in Alternative 2 and to a slightly higher degree then in Alternative 1. This is because initially more human activity would occur in the canyon to implement projects designed to enhance natural resources. Once those projects were completed, human activity in the canyon would decrease.

Alternative 4

Refer to Impacts Common to All Alternatives for discussions of actions to: Scenery Management, Road Management, Terrestrial Species/Habitat Management, Watershed Management, Range Management, Fire and Fuels Management and PacifiCorp Facilities. Other resource actions are discussed below.

Recreation Management - *Recreation trails (motorized and nonmotorized):* Several actions are proposed to enhance and improve non-motorized and motorized trails in Alternative 4. In addition to the construction of new non-motorized trails and converting old roads to trails, Alternative 4 focuses on developing new OHV trails and creating an improved parking area at the Salt Caves Overlook. All of these actions have the potential to impact cultural resources (see Map 16).

Allowing motorized access to areas that has had tightly controlled access in recent years (primarily PacifiCorp lands), increases the exposure of cultural resources to vandalism and illegal digging. However, it allows access to land that were, in the past, Native American traditional use areas. Although new trails open areas up to increased public use, converting old roads to trails can reduce impacts to cultural resources. These proposed restrictions reduce the number of people that use the area,, in turn, reduces the extent of vandalism and looting. Unfortunately, restrictions also limit Native American access to traditional use areas, especially for the elderly who may have difficulty walking.

Dispersed and developed recreational sites (proposed and enhancement of existing facilities): Alternative 4 focuses on enhancing and expanding existing camping facilities and developing new camping facilities. Enhancement and expansion of facilities such as Topsy Reservoir campground may involve adding electrical and water hook-ups. Ground disturbing activities such as this minimally effect cultural resources because campground locations are previously disturbed areas due to past campground development and heavy use of the areas.

Some dispersed use sites would be more formally developed by, hardening the bench area, developing group campsites, improving raft take-out facilities, constructing permanent bathrooms, and constructing a motorized bridge. There is potential for direct conflicts between recreation and the protection of cultural resources. However, hardening sites and confining usage to specific locations helps to decrease impacts to the cultural resources by drawing people away from the resources. However, improved facilities attract increased usage, which leads to unintentional damage, vandalism, soil compaction, and artifact collecting. Construction of a motorized bridge would provide access to the west side of the river. Access exposes previously undisturbed cultural resources, yet provides Native Americans an opportunity to visit traditional use areas.

Development of a Shovel Creek Campground would increase human presence in the area. Increased human pressure leads to increased deterioration of the cultural resources found in the area (see Map 16).

Interpretive/environmental education projects: Refer to Impacts Common to All Alternatives section.

Firearm use: Refer to Impacts Common to All Alternatives section.

Whitewater rafting (private and commercial): Management would enhance whitewater opportunities in Alternative 4 by upgrading toilets at Spring Island; hardening or surfacing parking and access roads, developing a boat launch, installing a toilet and campsites at Tom Creek Substation and Hoover Ranch; and developing a raft take-out at River Access #6. Constructing toilets has a positive effect on cultural resources because it discourages random defecation however, impact to buried cultural resources could potentially occur during construction. Hardening parking and access areas focuses usage impacts to specific areas designed to avoid any cultural resources present, and reduces erosion. Developing the Tom Creek Substation, Hoover Ranch and a raft take-out at River Access #6 would increase the traffic in the area and increase conflicts between recreation and cultural resources. Mitigation would be needed.

Motorized watercraft use: Refer to Impacts Common to All Alternatives section.

Cultural Resource Management - Prehistoric site management: Prehistoric sites are fragile, nonrenewable resources that are rapidly disappearing. Alternative 4 emphasizes site preservation utilizing four techniques: earth burial, filter fabric, vegetation, and fencing. Sites CA-SIS-1721 and 35KL20 would be protected using a combination of techniques: earth burial, filter fabric, and vegetation. The process would be as follows: filter fabric would be placed over the site; a covering of sterile earth fill would be spread over the site; and, native vegetation would be planted in the earth fill or the area could be reseeded. The filter fabric serves to separate the cultural deposit from the fill material. The advantage of this technique would be to protect the site from further trampling, vandalism, and erosion. These techniques can be expensive when adding up the cost of the fill, transpiration, filter fabric, placement labor, seeds or plants, and labor to reseed or plant. These actions however, can prevent ongoing damage to cultural sites.

Site CA-SIS-2135 would be protected using fencing. Fencing deters human and/or animal traffic and has a relatively low installation and maintenance cost. Unfortunately, a fence can be climbed or cut by those who are bent on destruction.

Establishing a caretaker protect site 35KL18would. Establishing a caretaker would be a very expensive move that would need yearly funding. However, having a continuous presence would deter vandalism and looting. In addition, it would provide someone in the canyon to answer questions, and enforce rules and safety.

Historic site management: Historic structures are rapidly deteriorating or have deteriorated past the point where preservation techniques are no longer affective. Alternative 4 focuses on stabilizing and rehabilitating several historic structures that still stand in the canyon (see Appendix H). These are Hoover 41 Ranch House, the Community Hall at the Beswick Complex, and the Truitt Saloon. Rehabilitation is defined as maintaining a structure as it currently exists and to protect it from deterioration. Stabilization is defined as the practice of making a structure stable or structurally sound and minimizing its deterioration while preserving its current appearance. Stabilization and rehabilitation have positive affects on historic structures. Although both techniques can be costly, stabilization and rehabilitation reduce deterioration so that the resource will be around for several more generations to learn from and enjoy.

In Alternative 4, a proposal to nominate the Topsy Road as a National Historic Trail is offered (see Map 16). National historic trails are recognized as important to American Culture in the National Trails System Act of 1968. The advantages of nominating the Topsy Road would be to clarify who is responsible for the management; coordination and cooperation with landowners, other federal agencies and interested public; development; interpretation; stabilization; protection; and visitor use of the trail. Limited financial assistance is available through this program.

Native American traditional use management: Refer to Impacts Common to All Alternatives section.

Terrestrial Species/Habitat Management - In Alternative 4, wildlife projects focus on the creation of perches, roosts, and nest sites that can vary in shape and size. Creating perches and nesting sites can consist of modifying power poles, pruning branches, topping/blasting treetops, maximizing the use of duck boxes, and installing nest boxes onto buildings. Implementing fuel reduction or vegetation thinning projects to create roost and nesting areas can negatively affect cultural resources. The treatments focus on mechanically thinning oak groves and brush-fields. Although the project areas would be surveyed and all sites avoided during the project, ground-disturbing equipment is used and damage is possible.

Watershed Management Actions - Meadow restoration proposed in Alternative 4 using three techniques: fencing, road removal, and revegetation. Actions designed to improve meadow conditions positively affects water quality and thus can positively affect the Klamath River's fish. The fish are an important aspect to local Native American cultures. Some view the fish as a Native American traditional property. Meadow improvements help reduce the effects of erosion.

Stream/fisheries flows: Refer to Impacts Common to All Alternatives section.

Instream structures/irrigation diversions: Refer to Impacts Common to All Alternatives section.

Land Tenure - Development of management agreements with PacifiCorp, or the BLM acquisition of, PacifiCorp land, would help facilitate protection for cultural resources and maintain the historic, prehistoric and traditional use values identified for the canyon, which would be a positive effect.

Cumulative Impacts - Alternative 4 effects are very similar to Alternative 2 except that the potential for impacts is much higher. The expansion of human use opportunities could result in irretrievable cultural resource loss. Drawing more people into the area by expanding access and facilities, increases the probability that cultural resources will be negatively affected through illegal collection of artifacts, vandalism, erosion, compaction, and unintentional disturbance.

Irretrievable, Irreversible, and Unavoidable Adverse Impacts

Any loss of a structure or site that is a part of history, potentially could be considered an irreversible impact. Activities, such as construction of recreation sites, building roads, or other projects that use wheeled or tracked vehicles, have the potential to cause irreversible impacts to cultural sites if they damage or destroy a site to a point that the inherent information could not be obtained. However, those impacts can be reduced through cultural resource surveys and mitigation measures mandated by Section 106 of the National Historic Preservation Act of 1966, as amended through 1992 (NHPA).

Vegetation and Soils

Special Status Plant Species

Assumptions/Impacts Common to All Alternatives

Under all alternatives, no negative effects on federal candidate, state listed, state candidate, Bureau sensitive, or Survey and Manage plant species would be expected because BLM policy is to conserve these species through protection of their habitats and populations. Surveys for special status plant species before ground disturbing activities would be designed to have a high probability to locate populations of these species. Under current BLM policy, effects on Bureau assessment and Bureau tracking species could occur at the discretion of the local manager.

Impacts of Specific Alternatives

(Refer to Maps 5, 6, 21 - 24, and Appendix H)

Alternative 1

Under this alternative, vegetation treatments, using both mechanical methods and prescribed fire, would be limited to current levels. Therefore, direct impacts to populations undetected during pre-project surveys or indirect impacts to habitat would be less likely than under alternatives with higher levels of ground disturbing management actions (see Map 21).

Due to the potential for wildfires from the higher fuel loads persisting over a longer period of time, special status plant populations may be affected by disturbance associated with fire suppression activities, and through alteration of the nutrient cycling regime of a site from the application of chemical flame-retardants. The vehicles and machinery entering the planning area to suppress any wildfires would increase the potential of disturbance of populations undetected by pre-project surveys. Additionally, higher fuel loads would result from ongoing wildfire suppression activities. Wildfires that burn in heavy, hazardous fuel loads would be high intensity, possibly canopy-replacing fires, to which many of the native understory species are not adapted. These fires would alter habitat and negatively affect populations of special status plant species.

Prescribed fire applied to areas could impact special status plant species if the fire is applied outside the season to which these plants are adapted to the occurrence of fire. However, the reduction of hazardous fuel levels and the reintroduction of fire as an ecosystem process could positively affect special status plant species that are adapted to a natural fire frequency and intensity.

Alternative 2

Under this alternative, vegetation treatments would occur over a larger area in order to promote the enhancement of Scenic River and ACEC values, primarily scenic and wildlife (see Map 22). Therefore, direct impacts to populations undetected by pre-project surveys would be more likely than in Alternative 1, but less likely than alternatives with higher levels of ground disturbing management actions. Indirect impacts to habitat would also be more likely under this alternative than in Alternative 1, however, these effects on habitat would be designed to be beneficial to native species in the long-term.

Fuels treatments would emphasize use of mechanical equipment, therefore, direct impacts to populations undetected by pre-project surveys would also be more likely than in Alternative 1.

However, indirect effects to habitat would be designed to benefit native species in the long-term.

The potential for impacts from wildfire management activities would be lower than in Alternative 1 since mechanical treatments would reduce hazardous fuel loads at a higher rate. However, the potential for impacts from fire suppression activities and high intensity, canopy-replacing fires, would be higher than Alternative 3 where large areas and high rates of both mechanical and prescribed fire habitat restoration activities are proposed.

The potential for direct impacts to populations undetected by pre-project surveys from the development of recreation sites is higher in this alternative than in Alternative 1. The potential for indirect impacts to habitat of special status plants from activities adjacent to these recreations sites is also increased. Increased levels of recreation activities also has the potential to increase the rate of introduction of noxious weeds which can impact special status plants directly through competition, and indirectly through alteration of habitat. If PacifiCorp's lands in California were acquired or managed by BLM under cooperative agreement, this potential to introduce noxious weeds through recreational activities would be expanded to these areas, which have restricted public access under current management.

Alternative 3

Under this alternative, large areas are proposed for vegetation treatments using both mechanical methods and prescribed fire in order to restore the stands to a more historically natural condition and maintain the health of the vegetation (see Map 23). Therefore, the potential for direct impacts to populations undetected by pre-project surveys would be highest of all the alternatives. However, the habitat and fuel reduction objectives would be designed to produce plant communities more typical of historic conditions under which these special status species evolved.

The more rapid reduction of heavy fuel loads would reduce the potential for impacts from fire suppression activities and high intensity, canopy replacing fires in the long-term. However, the increased level of ground disturbing activities may alter habitat such that early successional species, including noxious weeds, would have a competitive advantage in the short-term.

Prescribed fire applied to areas could impact special status plant species if the fire is applied outside the season to which these plants are adapted to the occurrence of fire. However, the reduction of hazard fuel levels and the reintroduction of fire as an ecosystem process could positively affect special status plant species that are adapted to a natural fire frequency and intensity.

The extensive removal of roads proposed in this alternative has the potential to have a beneficial effect on special status plant populations. For example, removal of roads that cross wet meadows will result in a more functional habitat, thus improving habitat for the red-root yampah (Perideridia erythrorhiza) and Howell's false caraway (Perideridia howellii) populations, which occur in these meadows.

Alternative 4

Under this alternative, vegetation treatments would be increased over current levels, but the additional areas treated would be concentrated around roads, high recreation use areas, and in important wildlife habitat (see Map 24). Therefore, direct impacts to populations undetected by pre-project surveys would be more likely than in Alternative 1, less likely than in Alternative 3, and similar to Alternative 2 but distributed differently across the landscape. Potential for indirect impacts to habitat would be similar to Alternative 2, however, these effects on habitat would be designed to be beneficial to native species in the long-term.

Fuels treatments would emphasize use of mechanical equipment; therefore, direct impacts to populations undetected by pre-project surveys would also be similar to Alternative 2. However, indirect effects to habitat would be designed to benefit native species in the long-term.

The potential for impacts from wildfire management activities would be similar to Alternative 2 since mechanical treatments would reduce hazardous fuel loads at a higher rate than in Alternative 1. However, the potential for impacts from fire suppression activities and high intensity, canopy-replacing fires would be higher than Alternative 3 where large areas and high rates of both mechanical and prescribed fire habitat restoration activities are proposed.

The potential for direct impacts to populations undetected by pre-project surveys from the more extensive development of recreation sites is relatively high in this alternative. The potential for indirect impacts to habitat of special status plants from activities adjacent to these recreations sites is also relatively high. Higher levels of recreation activities also has the potential to increase the rate of introduction of noxious weeds which can impact special status plants directly through competition, and indirectly through alteration of habitat. If PacifiCorp's lands in California were acquired or managed by BLM under cooperative agreement, this potential to introduce noxious weeds through recreational activities would be expanded to these areas, which have restricted public access under current management.

Noxious Weeds

Assumptions/Impacts Common to All Alternatives

The implementation of an Integrated Weed Management (IWM) program as defined in EA-014-93-09 is common to all alternatives. Integrated management of noxious weeds will include systematic inventories of the planning area, education, prevention, and control using manual, mechanical, chemical and biological methods.

Impacts of Specific Alternatives

(Refer to Maps 5, 6, 21-24, and Appendix H)

Alternative 1

Under this alternative, the potential for the introduction of noxious weeds into the planning area and the potential for the spread of noxious weeds within the planning area would remain the same (see Map 21). The vegetation management and recreation development activities would create disturbed conditions under which many noxious weeds have a competitive advantage relative to other species native to the site. The continued implementation of the Integrated Weed Management program would tend to decrease or at least stabilize the abundance and distribution of noxious weeds within the planning area.

Due to the potential for wildfire from the persistence of high fuel loads over a longer period of time, weed populations may have a competitive advantage under conditions resulting from the soil disturbance associated with fire suppression activities, and from alteration of the nutrient cycling regime of a site as a result of the application of chemical flame-retardants. The vehicles and machinery entering the planning area to suppress any wildfires would increase the potential for the introduction of noxious weeds from sources outside the planning area. Additionally, higher fuel loads would result from ongoing wildfire suppression activities. Wildfires that burn in heavy, hazardous fuel loads would be high intensity, possibly canopy replacing fires. These fuel conditions increase the potential for even greater disturbance in the event of wildfire, creating conditions under which many noxious weeds have a competitive advantage.

There would be the potential for introduction of noxious weeds into the area from sources outside the planning area on the vehicles and machinery used to implement prescribed fire projects.

Alternative 2

Under this alternative, vegetation treatments would occur over a larger area than Alternative 1, in order to promote the enhancement of Scenic River and ACEC values, primarily scenic and wildlife (see Map 22). Therefore, the disturbed conditions under which many noxious weeds have a competitive advantage would be more extensive than in Alternative 1, but less extensive than under alternatives with higher levels of ground disturbing management actions. Increased numbers of vehicles and machinery entering the planning area to implement these treatments would increase the potential for the introduction of noxious weeds into the area from sources outside the planning area. Post-project inventories proposed under this alternative would promote the early detection and treatment of new noxious weed populations established as a result of these actions.

Fuels treatments would emphasize the use of mechanical equipment, therefore, the disturbed conditions under which many noxious weeds have a competitive advantage would also be created by these activities. The vehicles and machinery entering the planning area to implement these treatments would increase the potential for the introduction of noxious weeds from sources outside the planning area. However, post-project inventories proposed under this alternative would promote the early detection and treatment of new noxious weed populations established as a result of these actions.

The potential for impacts associated with the disturbance created by wildfire management activities would be lower than in Alternative 1, since mechanical treatments would reduce hazardous fuel loads at a higher rate. However, the potential for impacts from fire suppression activities and high intensity, canopy-replacing fires would be higher than Alternative 3 where large areas and high rates of both mechanical and prescribed fire habitat restoration activities are proposed.

Increased levels of recreation activities, also has the potential to increase the rate of introduction of noxious weeds. If PacifiCorp lands in California were acquired or managed by BLM under cooperative agreement, this potential to introduce noxious weeds through recreational activities would be expanded to these areas, which have restricted public access under current management.

Alternative 3

Under this alternative, large areas are proposed for vegetation treatments using both mechanical methods and prescribed fire in order to restore the stands to a more historically natural condition (lower fuel loads) and maintain the health of the vegetation (see Map 23). Therefore, this alternative would create the largest area in the short-term that would create disturbed conditions under which many noxious weeds have a competitive advantage relative to other species native to the area. However, the habitat and fuel reduction objectives would be designed to produce plant communities more typical of historic conditions, which may be more resistant to noxious weed invasion in the long-term.

The greater extent of these activities would also have the most potential for the introduction of noxious weeds from the vehicles and machinery entering the planning area to implement these treatments. However, post-project inventories proposed under this alternative would promote the early detection and treatment of new noxious weed populations established as a result of these actions.

The more rapid reduction of heavy fuel loads would reduce the potential for impacts from fire suppression activities and high intensity, canopy-replacing fires in the long-term. Therefore,

the activities and conditions associated with wildfire management would have less potential to create the disturbed conditions under which many noxious weeds have a competitive advantage. Additionally, in the long-term, less vehicles and machinery would be entering the planning area to suppress wildfires, and the potential would be reduced for the introduction of noxious weeds into the area from sources outside the planning area.

Prescribed fire applied to areas through the random selection process and areas selected by the Interdisciplinary Team would reduce hazardous fuel levels, reintroduce fire as an ecosystem process, and thereby promote the development of the native plant communities adapted to a natural fire frequency and intensity. These plant communities would be more resistant to invasion by noxious weeds.

Alternative 4

Under this alternative, vegetation treatments would be increased over current levels, but the additional areas treated would be concentrated around roads, high recreation use areas, and in important wildlife habitat (see Map 24). Therefore, the area disturbed by these treatments would be larger than in Alternative 1, smaller than in Alternative 3, and similar to Alternative 2, but distributed differently across the landscape. The numbers of vehicles and machinery entering the planning area to implement these treatments would have a similar potential as Alternative 2 for the introduction of noxious weeds from sources outside the planning area. However, the periodic inventories adjacent to high use recreation areas would promote the early detection and treatment of new noxious weed populations established as a result of these actions.

Fuels treatments would emphasize use of mechanical equipment; therefore, the disturbed conditions under which many noxious weeds have a competitive advantage created by these activities would be over a similar area as under Alternative 2. The vehicles and machinery entering the planning area to implement these treatments would have the potential for the introduction of noxious weeds from sources outside the planning area. However, the periodic inventories adjacent to high use recreation areas would promote the early detection and treatment of new noxious weed populations established as a result of these actions.

The potential for impacts from wildfire management activities would be similar to Alternative 2 since mechanical treatments would reduce hazardous fuel loads at a higher rate than in Alternative 1. However, the potential for impacts from fire suppression activities and high intensity, canopy-replacing fires would be higher than Alternative 3 where large areas and high rates of both mechanical and prescribed fire habitat restoration activities are proposed.

The more extensive development of recreation sites under this alternative has the potential to create the disturbed conditions under which many noxious weeds have a competitive advantage relative to other species native to the area. Increased numbers of vehicles and machinery entering the planning area to implement these treatments, and the higher level of recreational use would increase the potential for the introduction of noxious weeds into the area from sources outside the planning area. If PacifiCorp lands in California were acquired or managed by BLM under cooperative agreement, this potential to introduce noxious weeds through recreational activities would be expanded to these areas, which have restricted public access under current management. However, the periodic inventories adjacent to high use recreation areas would promote the early detection and treatment of new noxious weed populations established as a result of these actions.

Forest and Woodlands

Assumptions/Impacts Common to All Alternatives

Vegetation treatments proposed under each alternative (see Appendix H) are designed to restore ecosystem health to the affected plant communities. In conifer forests and woodlands, this would be done mainly by thinning, followed by fuels reduction treatments, as described in Chapter 4. Brushfields would be kept in an early seral condition, mainly by prescribed burning, to maximize big game browse.

Since vegetation management prescriptions for treated acres are basically identical in all alternatives, the impacts to the vegetation from these treatments are assumed to be proportional to the area treated in each alternative.

For conifer forests and woodlands, beneficial impacts include improved stand condition and vigor, increased stand resistance to epidemic level insect attack, and reduced fuel levels and lower risk of catastrophic stand-replacing wildfires. Oak woodlands, in the long-term, would be restored to more natural oak savannas with large, full-crowned trees and grass understory. Mixed brush would be maintained by fire as younger, more palatable stems. Rabbitbrush-sagebrush areas and dry meadows would be maintained by removal of invasive oaks and other plants, by cutting or prescribed fire. Treatment areas would have disturbed soil, and would provide potential sites for noxious weed establishment.

Watershed management would potentially have impacts on vegetation commensurate with the area of vegetation treatments within riparian reserves. In these areas, vegetation would be subordinate to riparian and aquatic species values, and be modified and designed to enhance those values.

Terrestrial wildlife species and habitat would be benefited by the general vegetation treatments, as well as specific site treatments, like clearing under eagle nest trees to reduce moisture competition for the nest tree.

Fire and fuels would be directly affected by vegetative treatments, since reduction of fuels by mechanical methods or fire, are part of the proposed treatments. Fuel treatments would reduce risk of catastrophic stand-replacing wildfires, although the short-term risk of accidental fire during treatment operations will be greater.

The impacts of land tenure actions will vary with the area of land converted from private to public ownership, or to conservation easements, or management agreements. Due to the proposed land allocation of PacifiCorp lands in California as a river management area, a more certain source of funding may become available and these lands would be more likely to be treated to improve vegetative condition than other private lands.

Other resource management concerns would have little or no impact on vegetation, and will not be analyzed under each alternative. Scenery management would require maintenance of existing visual values. Thinnings, fuel reduction, and most prescribed burning would maintain these values. Construction of recreational facilities would convert a relatively small area of vegetation to other uses. Only a few acres of the over 19,765 acres in the planning area would be so directly affected. Protection of cultural sites would also have similar negligible impacts. Roads as proposed in the four alternatives would have only minor impacts on vegetation. Access to many treatment units is difficult under all alternatives; not every unit has a road leading to it. In these situations, temporary trails may be used to bring in equipment and work crews. Other treatment methods, such as helicopter yarding or helicopter ignition of burn units, are also available. Livestock grazing, as proposed, would have little impact on vegetation.

Impacts of Specific Alternatives

The following discussion of impacts is organized in groups of management actions that have similar project objectives and potential consequences.

(Refer to Maps 6, 21- 24, and Appendix H)

Alternative 1

Vegetation, Terrestrial Species and Habitat, and Fire and Fuels Management - As shown on Table 4-11, vegetative treatments for this alternative total 1,171 acres for the first decade of the plan. This is the smallest acreage of treatment of the four alternatives, and, in turn, would provide the smallest area of improved vegetative condition, reduced fuels, reduced risk of catastrophic wildfire, and improved wildlife habitat (see Map 21).

Watershed, and Aquatic Species and Habitat Management - The area of vegetative treatments within riparian reserves is 227 acres, or 19% of the total treatment area. Intensity, or area of treatment, could be modified to accommodate or enhance specific riparian or aquatic values.

Land Tenure - Even though acquisition of private lands is allowed under the current RMPs no vegetative treatments were planned to occur on PacifiCorp lands in this alternative.

Cumulative Impacts - Since this alternative has the smallest area of vegetative treatment; it also has the effect of minimizing the beneficial impacts of these treatments. Forest and woodland densities and fuel loads would continue to accumulate in non-treated areas, with increasing risk of insect attack and increased risk of catastrophic wildfire.

Alternative 2

Vegetation, Terrestrial Species and Habitat, and Fire and Fuels Management - Vegetative treatments for this alternative total 4,510 acres for the first decade of the plan. This is a "moderate" amount of treatment; more than Alternative 1, less than Alternative 3, and about equal to Alternative 4. It would provide a moderate level of beneficial impacts from improved vegetative condition, reduced fuels, and improved wildlife habitat (see Map 22).

Watershed and Aquatic Species and Habitat Management - The area of vegetation treatments within riparian reserves is 1,372 acres, or 30% of the total treatment area. Intensity or areas of treatment could be modified to enhance specific riparian or aquatic values.

Land Tenure - The additional proposed acquisition of private lands, or development of management agreements or conservation easements would primarily be in the Frain Ranch,, Shovel Creek, and Hayden Creek areas. This limitation has the effect of limiting the beneficial impacts of vegetation treatment outside these areas.

Cumulative Impacts - Since this alternative has a medium level of vegetative treatment, it has the effect of increased beneficial impacts compared to Alternative1, less than Alternative 3, and about the same as Alternative 4. Forest and woodland densities and fuel loads would continue to accumulate in non-treated areas, with increasing risk of insect attack and increasing risk of catastrophic wildfire.

Alternative 3

Vegetation, Terrestrial Species and Habitat, and Fire and Fuels Management - Vegetative treatments for Alternative 3 total 6,958 acres for the first decade (see Map 23). This is the

largest of the four alternatives, and in comparison, maximizes the beneficial impacts from improved vegetative condition, reduced fuels, and improved wildlife habitat.

Watershed, and Aquatic Species and Habitat Management - The area of vegetative treatments within riparian reserves is 1,761 acres, or 25% of the total treatment area. Intensity or area of treatment could be modified to accommodate or enhance specific riparian or aquatic values.

Land Tenure - Acquisition of lands, and execution of management agreements and conservation easements would be maximized under this alternative, and would help maximize vegetative treatment acres and positive impacts.

Cumulative Impacts - Since this alternative has the highest amount of vegetative treatment, it will also result in the highest level of beneficial impacts.

Alternative 4

Vegetation, Terrestrial Species and Habitat, and Fire and Fuels Management - Vegetative treatments for this alternative total 4,580 acres for the first decade of the plan (see Map 24). This is a "moderate" level of treatment, approximately the same as Alternative 2, more than Alternative 1, but less than Alternative 3. It would provide a moderate level of beneficial impacts from improved vegetative condition, reduced fuels, and improved wildlife habitat.

Watershed, and Aquatic Species and Habitat - The area of vegetative treatment within riparian reserves is 958 acres, or 21% of the total treatment area. Intensity, or areas of treatment could be modified to accommodate or enhance riparian or aquatic values.

Land Tenure - Acquisition of lands and development of management agreements or conservation easements would be at a high level, and would allow vegetative treatments to be maintained at a medium to high level.

Cumulative Impacts - Since this alternative has a medium level of vegetative treatment, it has the effect of increased beneficial impacts compared to Alternative 1, less than Alternative 3, and about the same as Alternative 2. Forest and woodland densities and fuel loads would continue to accumulate in non-treated areas, with increasing risk of insect attack and increased risk of catastrophic wildfire.

Irretrievable, Irreversible, and Unavoidable Impacts

For areas where vegetation treatments do not occur, then forest and woodland densities and fuel loads would continue to accumulate with increasing risk of insect attack and increased risk of catastrophic wildfire. This would have irreversible impacts to scenery, vegetative and biological resources if a wildfire were to occur.

Irrigated Meadows

Assumptions Common to All Alternatives

Any actions that initiate a change in management to irrigation systems or use of irrigated meadows would only be made as recommendations to PacifiCorp.

Impacts of Specific Alternatives

(Refer to Maps 5, 6, 21-24, and Appendix H)

Alternative 1

The irrigated meadows in Segment 3 would continue to be managed for commodity production, and would continue to consist of a mixture of native and introduced pasture grasses. Bullrush and willow dominated riparian communities would persist on the margins of pastures and near irrigation ditches. Dense sod mats would continue to form when decomposition of this pasture vegetation is impaired by moist conditions. Populations of yellow starthistle and other noxious weeds would continue to be a problem around the margins of the pastures and on the drier sites, and consistent treatment would be required to achieve control (see Map 21).

Alternative 2

It would be recommended that the 290 acres of irrigated meadows along the river in Segment 3 be adaptively managed to provide diverse native vegetation and wildlife habitat. Water deliveries to meadows that are irrigated solely (25 acres) or partly (70 acres) with water from the Negro Creek diversion would be reduced (see Map 22).

The desired vegetation would include tufted hairgrass and various species of native sedges and rushes. Willows and rushes would expand from their current extent at sites on the margins of the river and irrigation ditches, as well as establishing in areas with soils that are naturally inundated or that are hydrologically connected to the river or Shovel Creek via gravel lenses. On drier sites, existing meadow communities would persist unless other species are planted or become established. Native grass species that may be planted or become established would include California brome, western fescue and others. Yellow starthistle could expand as irrigation is curtailed, and appropriate weed control would be required. In the long-term, the extent and timing of irrigation would be based on monitoring results regarding the degree of natural inundation and the condition and composition of plant communities.

As a result of proposed management of the Segment 3 floodplain meadows, riverine riparian vegetation communities would develop deeper root systems and would receive lighter grazing pressure than at present. This would reduce bank erosion and associated detrimental impacts on existing riparian vegetation.

Improved irrigation efficiency or elimination of ditches would reduce the amount of seepage water available to riparian communities that have become established along ditches.

Alternative 3

It would be recommended that the 290 acres of irrigated meadows along the river in Segment 3 be adaptively managed to provide diverse native vegetation and wildlife habitat (see Map 23). Water deliveries to meadows (103 acres) that are irrigated with water from the Shovel Creek and Negro Creek diversions would be reduced and eventually eliminated. Use of some or all diversions from the river could also be altered and possibly eliminated, depending on the success of efforts to restore the natural functionality of desired vegetation communities.

The desired vegetation would include tufted hairgrass and various species of native sedges and rushes. Willows and rushes would expand from their current extent at sites on the margins of the river and irrigation ditches, as well as establishing in areas with soils that are naturally inundated or that are hydrologically connected to the river or Shovel Creek via gravel lenses. On drier sites, existing meadow communities would persist unless other species are planted or become established. Native grass species that may be planted or become established would include California brome, western fescue, and others. Starthistle could expand as irrigation is curtailed, and appropriate weed control would be required. In the long-term, the extent and timing of irrigation would be based on monitoring results regarding the degree of natural inundation and the condition and composition of plant communities.

As a result of proposed management of the Segment 3 floodplain meadows, riverine riparian vegetation communities would develop deeper root systems and would receive lighter grazing pressure than at present. This would reduce bank erosion and associated detrimental impacts on existing riparian vegetation.

Improved irrigation efficiency or elimination of ditches would reduce the amount of seepage water available to riparian communities that have become established along ditches. This effect would be more pronounced in this alternative than in Alternative 2.

Alternative 4

The irrigated meadows in Segment 3 would continue to be managed for commodity production, and would continue to consist of a mixture of native and introduced pasture grasses. Bullrush and willow dominated riparian communities would persist on the margins of pastures and near irrigation ditches (see Map 24). Dense sod mats would continue to form when decomposition of this pasture vegetation is impaired by moist conditions. Populations of yellow starthistle and other noxious weeds would continue to be a problem around the margins of the pastures and on the drier sites, and consistent treatment would be required to achieve control.

Riparian/Wetland Vegetation Communities

This portion of the environmental consequences discussion will focus primarily on the effects of proposed actions on riparian vegetation communities and the conditions that favor or impair their development, and will not describe potential consequences to "riparian reserves" and "riparian corridors" (refer to the discussion of Aquatic Conservation Strategy Components in the Watershed Values section).

Assumptions

The responses of riparian vegetation communities to proposed actions generally are not influenced by land ownership. A more detailed discussion of the location (including ownership) of specific types of impacts can be found in the Riparian Reserves section of the Aquatic Conservation Strategy Components discussion (in the Watershed Values section).

Coarse woody debris (CWD) plays important roles in developing conditions favorable for vegetation development. In streams, CWD can deflect streamflow and create pools, gravel bars, and areas where vegetation can develop. On terrestrial sites, CWD provides habitat, stabilizes soil, acts as a short-term regulator of soil moisture, and is a source of nutrients (Naiman et al. 1992, Wilford 1984).

The effectiveness of CWD in shaping riparian areas varies with piece stability and stream energy. In smaller streams and in wet meadows, relatively small pieces can help create sites for riparian vegetation to develop. In the river, large, stable CWD pieces contribute to developing sites for vegetation colonization. Generally, CWD stability increases as the ratio of piece length to channel width increases, and is enhanced when the piece is "anchored" or partly buried by bedrock, large rocks, trees or other CWD pieces, or gravel bars (Lienkamper and Swanson 1987).

Impacts Common to All Alternatives

Recreation Management - Campgrounds and other types of recreation developments within the planning area are generally not located on sites that have potential to support extensive riparian vegetation communities. Such sites are typically saturated for varying lengths of time during the year, and are not well-suited for recreation developments. Exceptions do occur,

however, and the location or use of some existing or proposed recreation developments may affect the composition and extent of riparian vegetation communities.

In all alternatives, camping would remain unrestricted. Dispersed sites near or in riparian areas are expected to receive similar levels of use in all alternatives. In Alternatives 1 and 3, use would be limited by poor access. In Alternatives 2 and 4, overall visitation within the planning could increase, but use would be focused primarily in developed recreation sites. Camping and associated activities can cause trampling of vegetation, soil compaction and displacement, and noxious weed introduction or dispersal.

OHV use would be limited to open roads and, consequently, damage to wet meadows and riparian areas (such as soil compaction, rutting, and removal of vegetation) would be reduced.

Road Management - Improved road surfaces and drainage features would reduce the delivery of road-generated runoff and sediment to riparian communities and would beneficially affect riparian vegetation and soils. Delivery of runoff and sediment from road surfaces can cause erosion of streambanks and other surfaces, can alter the hydrology of sites (for example, by decreasing groundwater inputs and reducing the length of time that a site is inundated), and can bury vegetation in low-lying areas adjacent to roads.

Improved road surfaces would be passable during wet weather, thereby eliminating the need for off road driving to circumvent impassable areas. The extent of road improvements near riparian areas varies by alternative.

It would be recommended that the bridges that cross Shovel Creek and Rock Creek be upgraded or retrofitted to allow passage of 100-year flood events. If implemented, these projects would disturb small portions of riparian vegetation but would reduce bank erosion and the risk of catastrophic bridge failure (and associated channel scour).

Cultural Resource Management - Utilization of Ethnobotanical resources is not expected to substantially affect riparian vegetation. Other proposed resource management activities may enhance the vigor or abundance of some native species.

Watershed Management - In the long-term, improved water quality and reduced nutrient loading in the Klamath River would reduce some of the competitive advantages that reed canary grass currently exploits. As a result, other native plants that are currently less widely distributed than reed canary grass would increase in abundance.

In a few wet meadows or tributary streams (Rock Creek Meadow, areas near Hayden Creek, and Middle Chert Creek meadow), enhanced or prolonged baseflow would favor the development of more extensive riparian vegetation communities or increased proportions of riparian obligate or facultative vegetation within existing riparian communities. There is a slight risk of increased peak flows in some streams. Higher peak flows, if they occur would potentially cause increased bank erosion and loss of riparian vegetation. This impact would be episodic, rather than ongoing, and would not significantly affect vegetation communities in the long-term.

Vegetation Management - *Upland vegetation treatments:* Vegetation treatments adjacent to riparian communities could reduce shading and CWD delivery, with consequent effects on evapotranspiration, soil moisture and organic matter content, and noxious weeds. By reducing the degree of shading within riparian areas, proposed treatments could maintain conditions that favor reed canary grass (Antieau, 1998).

Treatments in mixed conifer and riparian forest communities would reduce the short-term recruitment of smaller diameter CWD pieces and ensure the long-term recruitment of larger CWD pieces. The recruitment of large CWD may be reduced by some treatments in special habitat types, including some areas along the river.

Detrimental effects to riparian areas from upland vegetation treatments will be minimized by applying best management practices and designing management prescriptions for areas near waterbodies to ensure that riparian vegetation and soils and beneficially affected in the long-term.

Noxious weeds: Noxious weed treatments would occur within riparian vegetation communities in all alternatives. Although all herbicide label stipulations will be followed, some non-target species may be affected by chemical treatments. Overall, noxious weed management would beneficially affect the diversity and ecological function of riparian plant communities.

Range resources: In all alternatives, livestock use in riparian areas in Segment 2 would be reduced from current levels, and special habitats, including some riparian communities, would be exclosed from grazing. These actions would improve the vigor of riparian plants and enhance the nutrient content and structure of associated soils.

PacifiCorp Facilities - A low-voltage PacifiCorp transmission line traverses Exclosure Meadow (T41S-R6E-section 8). Maintenance of this line occurs sporadically (as needed) and requires use of mechanical equipment, leading to soil compaction and vegetation disturbance. A proposed mitigation measure would limit scheduled maintenance to periods when soils are dry, thereby reducing detrimental impacts of this ongoing activity.

Measures designed to limit the use and detrimental impacts of the emergency spillway are common to all alternatives. Decreased scouring at the site would result in reduced delivery of large boulders to the west bank of the river, thereby reducing scour of sediment and vegetation against the east bank. If PacifiCorp determines that the spillway is no longer needed, the site could be rehabilitated, and native vegetation reestablished.

The presence and operation of hydroelectric facilities can detrimentally affect riparian processes by creating daily fluctuations in downstream water levels during the growing season, blocking the supply of seeds and rooting matter from upstream, flushing seeds and seedlings during peaking operations, and reducing the supply of sediment available for incorporation into stream banks and gravel bars (Scott et al. 1993). The extent of some of these impacts varies by alternative. The physical barriers presented by J.C. Boyle Dam and other upstream dams would likely remain in place in all alternatives.

Fire and Fuels Management - Periodic prescribed fire could maintain and enhance wet meadows and riparian mixed conifer-hardwood forests by preventing encroachment of juniper and reducing competition among riparian plants. Fuel reductions accomplished by prescribed fire would reduce the likelihood of stand replacement fires in riparian forests. Prescribed fire use could result in the unintended mortality of some overstory trees, which would reduce shade but could result in beneficial short-term increases in CWD loading (Bragg 2000)

Impacts of Specific Alternatives

(Refer to Maps 5, 6, 21-24, and Appendix H)

Alternative 1

Recreation Management - *Site development:* No site development in the vicinity of riparian areas would occur in this alternative.

Site upgrades/expansion: No site upgrades or expansion would occur that would have the potential to substantially affect riparian areas.

Site rehabilitation/relocation: Decreased use at the dispersed sites on the west bank of the river near Frain Ranch would be reduced, and trampling of vegetation communities near these sites would decrease.

Trail network: Trails would cross through one wet meadow on the west bank of the river near Frain Ranch and near one wet meadow near Hell's Corner. Some trampling of vegetation communities and diversion of flow paths could occur. The trail near Frain Ranch would be located on the bed of an obliterated road, and the effects of the trail on riparian processes would be much less than the effects of the existing roads (see Map 13).

Trail maintenance would occur annually, and could include bucking of small diameter CWD. Although the stability of this material would be decreased in the two small tributary streams that the trail would cross, trail maintenance would have a negligible effect on channel forming processes that shape riparian communities. Project design features will limit the effect of trail maintenance on the stability of large CWD.

Recreation uses: No impacts from OHV use or camping would occur beyond that which is common to all alternatives.

Road Management - Relative to the other alternatives, Alternative 1 has the least extensive program of road obliteration in riparian areas. About 0.3 miles of road that traverse wetlands or riparian forests would be obliterated. Less than 0.1 miles of new road would be constructed in riparian communities. Road construction would affect portions of the floodplain of Chert Creek, but would occur coincident with obliteration of a road that is closer to the stream and is impairing riparian processes (see Map 17a and Appendix H).

Road obliteration would reduce compaction, allow revegetation and restoration of hydrologic flow paths, and reduce OHV use in four wet meadows in Segment 2. OHV use in two other meadows would be reduced as a result of obliteration of nearby roads. In the long-term, riparian vegetation may develop in some areas along old roads, and the growth and eventual mortality of trees growing on old roads would supply CWD to nearby riparian areas.

The extent of open roads near riparian areas is slightly lower in this alternative than in Alternative 4, but is higher than Alternatives 2 and 3. Wet meadows and riparian communities along streams (including the river) would be affected by reductions in CWD supply due to bucking and clearing of roadside hazard trees and fallen trees.

Road improvements designed to reduce runoff and sediment delivery would likely enhance the vigor of riparian vegetation in Rock Creek meadow, along Chert Creek and adjacent meadows, along Way Creek, and in the meadows along the lower portion of Shovel Creek. Other riparian areas may also be beneficially affected, though to a lesser degree.

Nine stream crossings in Segment 2 would be removed or improved in this alternative. Improved crossings at seven sites along streams would reduce detrimental impacts (such as diversion of flow paths, bank erosion, sediment delivery from roads, and disrupted transport of organic matter) to riparian processes along Frain Creek, Crayfish Creek, and two small streams near the powerhouse.

Crossing removal in two wet meadows will occur coincident with road removal, and will improve the hydrological and ecological function of riparian areas. Use of mechanical equipment to improve or remove crossings may cause short-term damage to riparian vegetation and soils, although BMPs will be applied to reduce the likelihood of such impacts.

Watershed Management - In Segment 1, flow regimes would not change from current conditions, and the encroachment of reed canary grass and other riparian vegetation into the river channel would continue. In Segments 2 and 3, peaking operations at the powerhouse would continue to cause large daily fluctuations in water levels. Proposed changes in flow

regimes would cause the magnitude of these fluctuations to be reduced slightly from current levels, though a zone of riparian vegetation subject to frequent inundation and exposure would still exist. Stabilized flows during late spring of average and wet water years would enhance the probability of successful establishment of riparian species along the river, although flow fluctuations would likely continue to impair riparian processes. Peaking flows would potentially have detrimental effects on the dispersal, establishment, and vigor of species that rely on seeds or cuttings.

Terrestrial Species/Habitat Management - Limited site-specific actions to benefit pond turtles, eagles, and woodpeckers would occur in this alternative. Proposed actions would result in reduced understory density and increased vigor of large trees. In the short-term, shade and CWD recruitment would be reduced. Desirable native riparian plant species could become established in areas affected by the proposed action, although conditions favored by reed canary grass could be created in some areas.

Aquatic Species/Habitat Management - Large scale process-based stream restoration treatments along the river would not occur in this alternative. The restricted supply of coarse sediment in the river would continue to impair the development of alluvial surfaces upon which riparian vegetation can become established. Unnaturally high width to depth ratios would persist in the river and tributary streams, accelerated rates of bank erosion and downcutting would continue, and floodplain inundation would occur rarely. Suitable sites for development of streamside riparian vegetation communities would be limited, and existing sites would continue to be damaged by altered rates of channel forming processes.

Vegetation Management - *Upland treatments:* Treatments within riparian reserves would affect the availability of sunlight, water, and CWD to wetland and riparian communities. The extent of proposed vegetation management actions is lowest in Alternative 1; about six percent of the acreage within riparian reserves would be affected. Few of these acres are near mapped riparian vegetation communities, however, and direct effects to riparian vegetation would be limited (see Map 21). Along small streams, proposed actions would reduce delivery of channel-forming CWD and could impair processes that create conditions suitable for some types of riparian vegetation (Beechie and Sibley 1997).

Riparian treatments: Seven wet meadows, covering about 15 acres, would receive passive restoration in the form of road obliteration and exclosure construction. These actions would reduce vehicle traffic through areas with soils sensitive to compaction and displacement, reduce the introduction and dispersal of noxious weeds, and improve conditions for development of native vegetation.

Range Management - Use levels in the planning area would not change substantially on either public or private land, relative to current conditions. Use in some wet meadows in Segment 2 would be decreased due to construction of exclosures. Trampling and consumption of riparian vegetation would continue in most areas that are currently affected by livestock use.

Fire and Fuels Management - The existing Fuels Management EA would continue to be in effect in the planning area. The fuels management program in this alternative would be less extensive than in other alternatives.

Cumulative Effects - Compared to other alternatives, a relatively small amount of riparian areas would be beneficially affected by restoration treatments. Proposed road obliteration and exclosure construction will affect about 13 acres of wet meadow habitat. Increased baseflow in small streams and reduced impacts from nearby roads would improve the condition of riparian vegetation in many wet meadows and riparian areas associated with small streams.

Together, road and vegetation management actions would maintain and restore the processes by which large CWD is supplied (via natural mortality of trees) to riparian areas along Chert

Creek and a portion of the river in Segment 2. In other areas, maintenance and use of roads and campgrounds would continue to reduce delivery of CWD to riparian areas.

Alternative 2

Recreation Management - *Site development:* The proposed Shovel Creek campground would be located on the relic floodplain of the Klamath River in Segment 3 (see Map 14). The hydrologic and geomorphic character of this area is no longer affected by annual flooding by the river, thereby changing the disturbance regime to which riparian communities adapt. Land use over the past century has also profoundly changed the vegetation community at the site. Despite these alterations, portions of the area are influenced by springs or are still hydrologically connected to the river via subsurface flow paths, and sedges, willows, and other riparian species are present. The proposed action would reduce the potential of the site to meet desired future conditions for riparian areas. Development of a large campground and associated facilities would entail site clearing, surface grading, and construction of roads and other impervious surfaces. These actions would alter surface and subsurface flow paths, with consequent effects on nutrient routing and oxygen availability. Riparian vegetation communities would be permanently covered or altered as a result.

Boat launches would not be built in areas that support extensive riparian areas. Development of these sites would have minor direct effects on riparian vegetation, and indirect effects would be limited due to the small extent of these sites.

Site upgrades/expansion: Increased use at some sites along the river (due to improved access or upgraded facilities) would lead to increased potential for interference with natural processes. No such sites are located within riparian communities, although some, such as the sites north of Frain Ranch and at Turtle Camp, are in close proximity to riverine and wet meadow riparian areas. Indirect impacts at these sites would include bank and vegetation trampling, wood cutting, and perhaps some unauthorized OHV use. Concentration of recreation use at developed dispersed sites would limit impacts near other, unimproved sites to their current levels.

Site rehabilitation/relocation: Rehabilitation at sites on the east side of the river at the south end of Frain Ranch and to the north of Frain Ranch would benefit the riparian communities adjacent to these sites. Native vegetation will, over time, contribute organic matter and ameliorate soil compaction. Some management intervention (planting of vegetation or manual de-compaction of soil) may be required to ensure that these areas recover to desired conditions.

Relocation of the northernmost site at the Klamath River Campground would reduce trampling and other detrimental impacts to a relatively extensive stand of willow that is nearby.

Trail network: Trails would cross numerous riparian areas along the river, four wet meadow areas in Segment 2, and portions of the relic floodplain in Segment 3, as well as portions of the riparian area along the middle portion of Shovel Creek. Where trails cross wet meadows and floodplains, minor impacts of trampling of vegetation communities and diversion of flow paths would occur. These trails will be located on the beds of decommissioned roads, and the effects of the trails on riparian processes will be much less than the effects of the existing roads (see Map 14).

Trail maintenance would occur annually, and could include bucking of small diameter CWD. The stability of this material during high streamflow events would be decreased. Project design features will limit the effect of trail maintenance on the stability of large CWD. Trail maintenance would have a negligible effect on channel forming processes that shape riparian communities.

Recreation uses: 49 acres of meadows would be made inaccessible to OHV use in this alternative. The designation of specific OHV tour routes, along with increased management presence, would potentially decrease motor vehicle damage to wetland soils and plant communities. Overall, less soil compaction and displacement in wet meadows would occur.

Road Management - In this alternative, about 0.9 miles of road that traverse wetlands or riparian forests will be decommissioned or obliterated. These actions would reduce compaction and allow revegetation and restoration of hydrologic flow paths in six wet meadows in Segment 2 and riparian areas adjacent to Shovel Creek. In the long-term, riparian vegetation may develop in some areas along old roads, and the growth and eventual mortality of trees growing on old roads would supply CWD to nearby riparian areas.

Improved access into and within the planning area could lead to increased OHV use in some wet meadows that would not be exclosed. Monitoring results will be reviewed to determine if additional areas need protection from OHV use.

Construction of one new bridge could cause direct and indirect detrimental impacts riparian areas. The total area directly affected would be relatively small. The bridges would be built in the vicinity of a site a bridge existed previously, in an area that does not support extensive riparian vegetation. The bridge would be designed to pass 100-year flood events, and indirect detrimental effects on channel processes, and thus bank and floodplain vegetation, would be minimized.

Bucking and clearing of roadside hazard trees and fallen trees would continue to affect CWD delivery to riparian communities. Due to extensive road obliteration within riparian reserves, detrimental impacts to CWD delivery would be substantially lower in this alternative than in Alternatives 1 and 4, though slightly higher than in Alternative 3. In general, detrimental effects of roads on CWD recruitment would be more pronounced in wet meadow areas than in streamside riparian areas.

Road improvements designed to reduce runoff and sediment delivery would likely enhance the vigor of riparian vegetation in Rock Creek meadow, along Chert Creek and adjacent meadows, along Way Creek, and in the meadows along the lower portion of Shovel Creek. Other riparian areas may also be beneficially affected, though to a lesser degree (see Map 18a).

Twenty stream crossings would be removed or improved in this alternative. These sites occur on tributary streams, primarily in Segment 2, but also in the Shovel Creek drainage in Segment 3.

Improved crossings at between 12 and 16 (depending on future needs to access powerlines) would reduce detrimental impacts (such as diversion of flow paths, increased bank erosion, increased sediment delivery from roads, and disrupted transport of organic matter) to riparian processes along Frain Creek, Crayfish Creek, Chert Creek, and two small streams near the powerhouse.

Crossing removal at between four and eight sites in four wet meadows and along Shovel Creek and Hayden Creek would occur coincident with road removal, and will ensure that crossings do not continue to affect riparian processes. Past channel and riparian adjustments to the effects of the crossing structure (i.e., eroded streambanks or bare ground) may persist. Use of mechanical equipment to improve or remove crossings could cause short-term damage to riparian vegetation and soils, although BMPs will be applied to reduce the likelihood of such impacts.

Watershed Management - Baseflows in Segment 1 would be increased, and riparian vegetation would likely be more vigorous as a result of increased water availability. Vegetation that has encroached into the stream channel would eventually be pushed back to

the wetted edge established by the increased baseflows. Peak flows in this segment would continue to be of reduced magnitude and frequency, and riparian vegetation would continue to encroach into the river channel. The reduced rate of down-ramping during peak flow events would reduce the rate at which the water table declines, which could enhance the establishment of willows and other riparian shrubs.

In Segments 2 and 3, the magnitude of water level fluctuations caused by peaking operations would be greatly reduced. On a daily basis, water surface levels would fluctuate by less than a foot (as measured at the USGS J.C. Boyle gage). Stabilized flows and reduced peaking would enhance the probability of successful establishment of riparian species other than reed canary grass. The timing and duration of riparian inundation hydroperiods would still be affected by J.C. Boyle operations, but too a much lower degree than at present. Water table elevations near the river would be high in the spring and gradually recede over the course of the summer. Within that seasonal pattern, water table elevations would fluctuate on a daily basis.

In tributary streams, enhanced or prolonged baseflow would favor the development of more extensive riparian vegetation communities or increased proportions of riparian obligate or facultative vegetation within existing riparian communities. In some streams, increased peak flows would potentially cause increased bank erosion and loss of riparian vegetation. This impact would be episodic, rather than ongoing, and would not significantly affect vegetation communities in the long-term.

If management recommendations regarding the irrigated meadows in Segment 3 were implemented, increased water would remain in Shovel and Negro Creeks during the growing season, which would likely increase the extent and vigor of riparian communities. Reduced use and increased efficiency of irrigation ditches would reduce the extent of riparian communities associated with the diversions.

Terrestrial Species/Habitat Management - The geographic scope and intensity of proposed actions to benefit pond turtles, eagles, and woodpeckers in this alternative are increased relative to Alternatives 1 and 4 and are approximately equivalent with Alternative 3. Proposed actions would result in reduced understory density and increased vigor of large trees. In the short-term, shade and CWD recruitment would be reduced. Desirable native riparian plant species could become established in areas affected by the proposed action, although conditions favored by reed canary grass could be created in some areas.

Aquatic Species/Habitat Management - Process-based stream restoration treatments (such as gravel replenishment and CWD placement) applied to the river would potentially affect extensive areas of riverine riparian areas. In combination with proposed changes in flow regimes and structural treatments (including channel geometry modifications and sidecast removal), these actions would beneficially affect multiple processes that shape riparian communities.

Partial restoration of the sediment regime in the river would lead to formation of point bars that could support riparian obligate and facultative vegetation communities. Willow, cottonwood, and sedge-rush communities could develop where conditions currently do not support these vegetation types.

Removal of road sidecast from the river at some sites below the flume access road in the upper portion of Segment 1 would allow recovery of vegetation communities that are currently buried. Installation of bankfull benches in this reach would create sites favorable for development of riparian communities.

Channel realignment in the vicinity of old bridges, diversion structures, and in areas with very high width-to-depth ratios would increase bank stability and would increase the extent of areas with the potential to support riparian communities. Patterns of floodplain inundation

(with both water and sediment) would be partially restored, resulting in more diverse assemblages of riparian vegetation species and age classes.

Proposed actions designed to limit fish stranding in secondary channels would likely have no effect on riparian vegetation, since the processes that control secondary channel formation and inundation frequency would not be specifically addressed.

Limited CWD placement in tributary streams would restore processes that create favorable sites for vegetation development. Restoration treatments would be focused primarily in reaches of Hayden and Shovel Creeks that have been most impacted by past land use. Expected results include increased inundation of floodplains and development of channel features (such as off-channel ponds and pools), and would favor riparian obligate and facultative plant species. Planting of desired species (e.g., willow or sedges) would occur at some treatment sites and would expedite recovery of riparian habitat.

Vegetation Management - *Upland treatments:* Treatments within riparian reserves would affect the availability of sunlight and CWD to wetland and riparian communities. With proposed actions affecting about 36 percent of the acreage within riparian reserves, the extent of proposed vegetation management actions is higher in Alternative 2 than in Alternatives 1 and 4.

Portions of treatment units are adjacent to small wet meadows along the river, Exclosure and Rock Creek Meadows, and the irrigated meadows in Segment 3. Short-term reductions in small CWD and long-term increases in the availability of large CWD would, in the long-term, benefit these meadows. Along small streams, proposed actions would reduce delivery of small CWD and thereby impair channel-forming processes that create conditions for riparian vegetation establishment.

Riparian treatments: A variety of treatments are proposed for approximately 216 acres of riparian and wetland plant communities in Alternative 2.

Obliterating roads or constructing obstructions to OHV would enhance a total of about 49 acres within 12 wet meadows or cattle use. These actions would reduce soil compaction and displacement, reduce the introduction and dispersal of noxious weeds, and improve conditions for development of native vegetation (see Map 18a).

Additional treatments would occur as necessary in the meadows near Hayden Creek and at Exclosure Meadow (T41S-R6E-section 8) in order to facilitate restoration, and may include prescribed burns, reseeding, soil treatments, and recontouring of areas that have been ditched or diked. These actions would accelerate the recovery of soil properties and hydrologic processes, and would restore native plant communities.

About 155 acres of riparian mixed conifer-hardwood forest along the lower portions of Shovel and Negro Creeks would be thinned in Alternative 2. The proposed action would remove selected young conifers and alder in order to release cottonwood and mid-seral pine. This would maintain the late-seral condition of this forest, thereby ensuring the long-term vitality of large coniferous and deciduous trees to provide shade, CWD, and wildlife habitat. Similar, though less intensive, treatments would occur in portions of the riparian hardwood forests along Hayden Creek (approximately 3 acres).

Proposed blackberry and reed canary grass treatments would reduce the extent of these species and enhance the structure, diversity, and function of riparian communities along the river and Shovel Creek.

Range Management - In addition to the effects that are common to all alternatives, use levels in Segment 3 would decrease relative to current conditions. This would likely improve the health of riparian communities that are not within exclosures.

Fire and Fuels Management - The existing Fuels Management EA would continue to be in effect in the planning area. The fuels management program in this alternative would be more extensive than in Alternative 1 but less extensive than Alternative 3.

Cumulative Effects - Riverine processes and landforms that create conditions favorable for riparian vegetation establishment would be partially restored in this alternative. Road and vegetation management actions would maintain and restore the processes by which large CWD is supplied to riparian areas. The extent of native riparian communities along the river would likely increase, especially in Segments 2 and 3.

Flow regimes more reflective of natural conditions would benefit riverine riparian communities. The reduced magnitude of daily flow fluctuations would improve vegetation recruitment and establishment. Riparian conditions in Segment 3 would be improved by restoration of the floodplain wet meadows and reduced grazing.

The composition and condition of riparian mixed conifer-hardwood forests along Shovel, Negro, and Hayden Creek would be beneficially affected by vegetation treatments, road obliteration, and instream restoration projects.

Increased baseflow in small streams and reduced impacts from nearby roads would improve the condition of riparian vegetation in many wet meadows and riparian areas associated with small streams.

Removing or reducing the use of irrigation diversions would adversely affect riparian communities that have developed along ditches or in areas of ditch seepage, though channel restoration in natural streams that have been adversely affected by diversion structures would eventually create areas that could support riparian vegetation.

Alternative 3

Recreation Management - *Site development:* The proposed Shovel Creek Hot Springs day use area would impact a small area on the relic floodplain in Segment 3. Some loss of riparian vegetation could occur, and the function of other adjacent areas may be altered as a result of runoff and trampling (see Map 15).

Site upgrades/expansion: No site upgrades within riparian areas are proposed in this alternative.

Site rehabilitation/relocation: Visitor use of sites near riparian areas would decrease as a result of road decommissioning and obliteration. Sites would be rehabilitated at Turtle Camp and on both sides of the river at Frain Ranch. Native vegetation would, over time, contribute organic matter and ameliorate soil compaction. Some management intervention (planting vegetation or manually de-compacting soils) may be required to ensure that these areas recover to desired conditions.

Relocation of sites within the Klamath River Campground to a distance of at least 100 feet from the river would reduce detrimental impacts to nearby vegetation communities, including a relatively extensive stand of willow. Some trampling of nearby vegetation would continue to occur, since use in this part of the canyon would still be concentrated in the campground (see Map 15).

The raft launch area and campsites on the lower bench at Stateline would be relocated to Access 6, which is located on the relic floodplain of the river. Both Stateline and Access 6 are located on benches above the current flood prone area, so direct effects on riparian vegetation as result of the relocation would be limited. Riparian vegetation at Access 6 (associated with irrigation diversion points and seepage from ditches) could potentially be affected by visitor use near the new site, although in this alternative irrigation diversions along the river may be removed.

Trail network: Trails would cross four wet meadow areas in Segment 2 and portions of the riparian area along the middle portion of Shovel Creek. Where trails cross wet meadows and floodplains, trampling of vegetation communities and diversion of flow paths would occur. Some of these trails will be located on the beds of decommissioned roads, and the effects of the trails on riparian processes will be much less than the effects of the existing roads.

Trail maintenance would occur annually, and could include bucking of small diameter CWD. The stability of this material during high streamflow events would be decreased. Project design features will limit the effect of trail maintenance on the stability of large CWD. Trail maintenance would have a negligible effect on channel forming processes that shape riparian communities. The floodplains in Segment 3 that will be affected by trails are bordered by mixed brush and open oak vegetation communities that would not contribute large volumes of CWD, so trail maintenance would cause very minor impacts to the abundance of CWD.

Recreation uses: Fifteen wet meadows, encompassing about 62 acres, would be protected from OHV use. Decreased patrols would reduce opportunities for visitor contact and enforcement. Monitoring of OHV damage to riparian areas would occur, and additional actions to protect wet meadows would be taken if necessary.

Road Management - In this alternative, no new roads would be constructed in riparian communities and about 1.1 miles of road that traverse wetlands or riparian forests would be obliterated (see Map 19a).

Road decommissioning and obliteration would reduce compaction, allow revegetation and restoration of hydrologic flow paths, and reduce OHV use in seven wet meadows in Segment 2 and the Shovel Creek riparian area. In the long-term, riparian vegetation may develop in some areas along old roads, and the growth and eventual mortality of trees growing on old roads would supply CWD to nearby riparian areas.

Bucking and clearing of roadside hazard trees and fallen trees would continue to affect CWD delivery to riparian communities. Due to extensive road obliteration within riparian reserves, detrimental impacts to CWD delivery would be substantially reduced in this alternative relative to Alternatives 1 and 4, and slightly lower relative to Alternative 2. In general, detrimental effects of roads on CWD recruitment would be more pronounced in wet meadow areas than in streamside riparian areas.

Road improvements designed to reduce runoff and sediment delivery would likely enhance the vigor of riparian vegetation in Rock Creek meadow, along Chert Creek and adjacent meadows, and along Way Creek. Other riparian areas may also be beneficially affected, though to a lesser degree.

Twenty-four stream crossings would be removed or improved in this alternative. These sites occur on tributary streams, primarily in Segment 2 but also in the Shovel Creek drainage.

Improved crossings at between 13 and 17 sites (depending on future needs to access powerlines) would reduce detrimental impacts (such as diversion of flow paths, bank erosion, sediment delivery from roads, and disrupted transport of organic matter) to riparian processes along Frain Creek, Chert Creek, Shovel Creek, Negro Creek, two small streams near the powerhouse, and downslope from Exclosure Meadow.

Crossing removal at between seven and eleven sites in wet meadows and along Chert, Hayden, and Shovel Creeks will occur coincident with road removal, and will ensure that crossings do not continue to affect riparian processes. Past channel and riparian adjustments to the effects of the crossing structure (i.e., eroded streambanks or bare ground) may persist. Use of mechanical equipment to improve or remove crossings may temporarily damage riparian vegetation and soils, although BMPs will be applied to reduce the likelihood of such impacts.

Watershed Management - Alternative 3 proposes the greatest increase in baseflows in Segment 1. Increased water availability would likely increase the vigor of riparian vegetation. Vegetation that has encroached into the stream channel would eventually be pushed back to the wetted edge established by the increased baseflows. The proposed increase in the frequency of flows capable of scouring the channel and transporting sediment would increase the diversity of riverine features and thereby increase the species and structural diversity of riparian communities along the river. The reduced rate of down-ramping during peak flow events would reduce the rate at which the water table declines, which could enhance the establishment of willows and other riparian shrubs.

In Segments 2 and 3, the run-of-the-river flow regime would benefit riverine riparian areas. Flow fluctuations that inundate and expose riparian areas would be mostly eliminated, and the pattern and timing of floodplain inundation would resemble that which occurred prior to the construction of J.C. Boyle Dam. For example, areas that are inundated by 3,000 cfs events would be submerged in late winter or early spring, rather than in the middle of summer. Water table elevations near the river would be high in the spring and gradually recede over the course of the summer. These conditions, in concert with altered geomorphic conditions (discussed below), would favor the establishment of willows and shrubs.

In tributary streams, enhanced or prolonged baseflow would favor the development of more extensive riparian vegetation communities or increased proportions of riparian obligate or facultative vegetation within existing riparian communities. In some streams, increased peak flows would potentially cause increased bank erosion and loss of riparian vegetation. This impact would be episodic, rather than ongoing, and would not significantly affect vegetation communities in the long-term.

If management recommendations regarding irrigation diversions are implemented, the use of irrigation diversions would be decreased and the timing of use would be shifted. Increased water would remain in Shovel and Negro Creeks during the growing season, which would likely increase the extent and vigor of riparian communities. Reduced use and increased efficiency of irrigation ditches would reduce the extent of riparian communities associated with the diversions.

Terrestrial Species/Habitat Management - The geographic scope and intensity of proposed actions to benefit pond turtles, eagles, and woodpeckers in this alternative are increased relative to Alternatives 1 and 4 and are approximately equivalent with Alternative 2. Proposed actions would result in reduced understory density and increased vigor of large trees. In the short-term, shade and CWD recruitment would be reduced. Desirable native riparian plant species could become established in areas affected by the proposed action, although conditions favored by reed canary grass could be created in some areas.

Aquatic Species/Habitat Management - Process-based stream restoration treatments (including gravel replenishment, CWD placement, and development of more natural flow regimes) applied to the river would potentially affect extensive areas (see Map 27). In combination with proposed structural treatments (including channel geometry adjustments and sidecast removal), these actions would beneficially affect multiple processes that shape riparian communities.

Restoration of the sediment regime in the river would lead to formation of point bars that could support riparian obligate and facultative vegetation communities. Willow, cottonwood, and sedge-rush communities could develop where conditions currently do not support these vegetation types. The episodic nature of unregulated sediment transport regimes would lead to development of a wide array of fluvial features and seral stages (due to occasional disturbances). Increased diversity in community composition and structure would result. Restoration of sediment regimes as proposed in Alternative 3 takes a holistic approach and is more likely to result in beneficial effects over a wider area than the actions proposed in Alternatives 2 and 4.

The removal of road sidecast from the river below the flume access road in the upper portion of Segment 1 would allow recovery of vegetation communities that are currently buried. Installation of bankfull benches in this reach would create sites favorable for development of riparian communities. The extent of area restored to natural conditions would be more extensive in this alternative than in Alternatives 1 (which does not propose any channel restoration in Segment 1), 2 and 4, and the expected beneficial effect to riparian vegetation is highest in this alternative.

Channel realignment in the vicinity of old bridges, diversion structures, and in areas with high width-to-depth ratios would increase bank stability and would increase the extent of areas with the potential to support riparian communities. Spatial and temporal patterns of floodplain inundation (with both water and sediment) would be partially restored, resulting in more diverse assemblages of riparian vegetation species and age classes. The extent of proposed instream restoration treatments is highest in this alternative.

Proposed actions designed to reduce the occurrence and inundation frequency of secondary channels would favor the development of riparian communities. Increased channel roughness, reduced frequency of flows with sufficient power to scour vegetation, and increased deposition of gravel would create conditions favorable for riparian vegetation.

Extensive CWD placement in fish-bearing tributary streams (including the river) would restore processes that affect vegetation development. Expected results include increased inundation of floodplains and development of channel features (such as lateral point bars and off-channel wetlands) that would favor riparian plant species. Planting of desired species (e.g., willow or sedges) that would occur at some treatment sites would enhance the recovery of riparian communities.

Vegetation Management - *Upland treatments:* Treatments within riparian reserves would affect the availability of sunlight and CWD to wetland and riparian communities. With proposed actions affecting about 47 percent of the acreage within riparian reserves, the extent of proposed vegetation management actions is highest in Alternative 3 (see Map 23).

Portions of treatment units are adjacent to small wet meadows along the river, Exclosure and Rock Creek Meadows, and the irrigated meadows in Segment 3. Short-term reductions in small CWD and long-term increases in the availability of large CWD would, in the long-term, benefit these meadows. Along small streams, proposed actions would reduce delivery of small CWD and thereby impair channel-forming processes that create conditions for riparian vegetation establishment.

Riparian treatments: A variety of treatments are proposed or considered for approximately 240 acres of riparian and wetland plant communities in Alternative 3.

Obliterating roads and constructing obstructions to OHV or cattle use, would enhance a total of about 62 acres of meadows. OHV and cattle use would be eliminated from 15 meadows, including areas near Hayden Creek and along the river. These actions would reduce soil compaction and displacement, reduce the introduction and dispersal of noxious weeds, and improve conditions for development of native vegetation.

Additional measures would be implemented as necessary in the meadows near Hayden Creek and at Exclosure and Rock Creek meadows (and be recommended for portions of private timber land) in order to facilitate restoration, and may include prescribed burns, reseeding, soil treatments, and recontouring of areas that have been ditched or diked. These actions would accelerate the recovery of soil properties and hydrologic processes, and would restore native plant communities.

About 170 acres of riparian mixed conifer-hardwood forest along the lower portions of Shovel and Negro Creeks would be thinned in Alternative 3. The proposed action would remove

young conifers and alder in order to release cottonwood and mid-seral pine. This would maintain and restore late-seral conditions, thereby ensuring the long-term vitality of large coniferous and deciduous trees to provide shade, CWD, and wildlife habitat. Similar treatments would occur in portions of the riparian hardwood forests along Hayden Creek (approximately eight acres). Other riparian forests in the planning area, including deciduous forest patches along the river, would be evaluated for treatments ranging from light understory thins to planting of desired trees species.

Proposed blackberry and reed canary grass treatments would reduce the extent of these species and enhance the structure, diversity, and function of riparian communities along the river and Shovel Creek.

Range Management - No grazing use would occur within the planning area, except as needed to meet vegetation management objectives. Riparian communities would benefit, as trampling and bank shear caused by cattle would decrease, and riparian vegetation would not be consumed as forage.

Fire and Fuels Management - The existing Fuels Management EA would continue to be in effect in the planning area. The fuels management program would be most extensive in this alternative.

Cumulative Effects - Efforts to restore natural flow regimes and riverine processes and landforms that create conditions favorable for riparian vegetation establishment would be most extensive and have the highest likelihood of success in this alternative. Instream restoration projects and altered irrigation management would cause a net benefit to wetland and riverine riparian areas in Segment 3.

Road and vegetation management actions would maintain and restore the processes by which large CWD is supplied to riparian areas. The extent of native riparian communities along the river would likely increase throughout the planning area.

Flow regimes reflective of natural conditions would benefit riverine riparian communities. Riparian conditions in Segment 3 would be improved by restoration of the floodplain wet meadows and limited grazing.

The composition and condition of riparian mixed conifer-hardwood forests along Shovel, Negro, and Hayden Creek would be beneficially affected by vegetation treatments, road obliteration, and instream restoration projects. Road obliteration would benefit riparian areas along Chert Creek and near the mouth of Frain and Crayfish Creeks.

Alternative 4

Recreation Management - *Site development:* The proposed Shovel Creek Campground would be located on the relic floodplain of the Klamath River. The current hydrologic and geomorphic character of this area is no longer affected by annual flooding by the river, thereby changing the disturbance regime to which riparian communities adapt. Land use over the past century has also profoundly changed the vegetation community at the site. Despite these alterations, portions of the area are influenced by springs or are still hydrologically connected to the river via subsurface flow paths, and sedges, willows, and other riparian species are present. The proposed action would adversely affect the potential of the site to meet desired future conditions for riparian areas. Development of a large campground and associated facilities would entail site clearing, surface grading, and construction of roads and other impervious surfaces. These actions would alter surface and subsurface flow paths, with consequent effects on nutrient routing and oxygen availability. Riparian vegetation communities would be permanently covered or altered as a result (see Map 16).

Boat launches would not be built in areas that support extensive riparian areas. Development of these sites would have minor direct effects on riparian vegetation, and indirect effects would be limited due to the small extent of these sites.

Visitor use near the proposed Big Bend campground would cause trampling of riparian vegetation along the river.

Site upgrades/expansion: Increased use at some sites along the river (due to improved access or upgraded facilities) would lead to increased potential for interference with natural processes. Recreation use levels in this alternative would be higher than in the other alternatives. No existing recreation sites are located within riparian communities, although some, such as the dispersed sites at the Old Bridge area and Turtle Camp, are in close proximity to riverine and wet meadow riparian areas. Impacts at these sites would include bank and vegetation trampling, wood cutting, and perhaps some unauthorized OHV use. Concentration of recreation use at developed dispersed sites would limit impacts near other, unimproved sites to their current levels.

The proposed expansion of the Klamath River Campground would lead to increased use at this site. Damage to riparian vegetation caused by bank trampling would increase. In addition, more hazard trees near the river would be felled, potentially decreasing CWD recruitment in nearby riparian areas.

Site rehabilitation/relocation: No rehabilitation of recreation sites near riparian communities would occur.

Trail network: Trails would cross numerous riparian areas along the river, five wet meadow areas in Segment 2, the relic floodplains in Segment 3, and portions of the riparian forest along the middle and upper portions of Shovel Creek. The trail network adjacent to Shovel Creek would be most extensive in this alternative (see Map 16).

Where trails cross wet meadows and floodplains, minor impacts of trampling of vegetation communities and diversion of flow paths would occur. These trails will be located on the beds of decommissioned roads, and the effects of the trails on riparian processes will be much less than the effects of the existing roads.

Trail maintenance would occur annually, and could include bucking of small diameter CWD. The stability of this material during high streamflow events would be decreased. This impact will be greatest in this alternative. Project design features will limit the effect of trail maintenance on the stability of large CWD. Trail maintenance would have a negligible effect on channel forming processes that shape riparian communities. The floodplains in Segment 3 that will be affected by trails are bordered by mixed brush and open oak vegetation communities that would not contribute large volumes of CWD, so trail maintenance would involve very little CWD management.

Recreation uses: A total of 17 acres in nine wet meadows would be exclosed from OHV use. Along with the designation of specific OHV tour routes and increased management presence, these actions would greatly decrease motor vehicle damage to wetland soils and plant communities.

Road Management - In this alternative, about 0.5 miles of road that traverse wetlands or riparian forests would be obliterated. Slightly less than 0.5 miles of new road would be constructed in riparian communities and on the relic floodplain in Segment 3 (see Map 20a).

Road construction would occur primarily in the vicinity of the Shovel Creek Campground, and would permanently remove floodplain vegetation and alter surface and subsurface flow paths. The extent and composition of riparian communities would change, and there would be

an increased likelihood of noxious weeds introductions, causing an overall adverse effect to riparian communities.

Road obliteration would reduce compaction, allow revegetation and restoration of hydrologic flow paths, and reduce OHV use in four wet meadows in Segment 2 and portions of the Shovel Creek riparian forest. In the long-term, riparian vegetation may develop in some areas along old roads, and the growth and eventual mortality of trees growing on old roads would supply CWD to nearby riparian areas.

Construction of two bridges could cause direct and indirect detrimental impact riparian areas. The total area directly affected would be relatively small. Bridges would be built in the vicinity of where previous bridges existed, in areas that do not support extensive riparian vegetation. Bridges will be designed to pass 100-year flood events, and indirect detrimental effects on channel processes, and thus bank and floodplain vegetation, would be minimized.

Improved access into portions of the planning area could lead to increased OHV use in sensitive areas that are not exclosed. Monitoring results will be reviewed to determine if additional areas need protection from OHV use (see Map 16 and 20a).

The extent of open roads near riparian areas is greatest in this alternative, and wet meadows and riparian communities along streams (including the river) would be affected by reductions in CWD supply due to bucking and clearing of roadside hazard trees and fallen trees.

Road improvements designed to reduce runoff and sediment delivery would likely enhance the vigor of riparian vegetation in Rock Creek meadow, along Chert Creek and adjacent meadows, along Way Creek, and in the meadows along the lower portion of Shovel Creek. Other riparian areas may also be beneficially affected, though to a lesser degree.

Thirteen stream crossings would be removed or improved in this alternative, more than in Alternative 1 but less than in Alternatives 2 and 3. These sites occur on tributary streams, primarily in Segment 2 but also in the Shovel Creek drainage in Segment 3. Improved crossings at nine sites would reduce detrimental impacts (such as diversion of flow paths, increased bank erosion, increased sediment delivery from roads, and disrupted transport of organic matter) to riparian processes along Chert Creek, Frain Creek, and two small streams near the powerhouse.

Crossing removal in two wet meadows in Segment 2 would occur coincident with road removal, and will ensure that crossings do not continue to affect riparian processes. Past channel and riparian adjustments to the effects of the crossing structure (i.e., eroded streambanks or bare ground) may persist. Use of mechanical equipment to improve or remove crossings may temporarily damage riparian vegetation and soils, although BMPs will be applied to reduce the likelihood of such impacts.

Watershed Management - In Segment 1, baseflows would increase relative to current conditions, perhaps making a larger area suitable for riparian vegetation. Vegetation that has encroached into the stream channel would eventually be pushed back to the wetted edge established by the increased baseflows. Peak flows in this segment would continue to be of reduced magnitude and frequency, and riparian vegetation would continue to encroach into the river channel. The reduced rate of down-ramping during peak flow events would reduce the rate at which the water table declines, which could enhance the establishment of willows and other riparian shrubs.

In Segments 2 and 3, peaking operations at the powerhouse would continue to cause daily fluctuations in water levels during some periods of the year. Proposed flow regimes would cause reductions in the frequency and magnitude of these fluctuations, though a zone of riparian vegetation that is frequently inundated and exposed would still exist. Stabilized flows during late spring of average and wet water years would enhance the probability of successful

establishment of riparian species along the river, although flow fluctuations would likely continue to impair riparian processes. Peaking flows would potentially have detrimental effects on the dispersal, establishment, and vigor of species that rely on seeds or cuttings.

In tributary streams, enhanced or prolonged baseflow would favor the development of more extensive riparian vegetation communities or increased proportions of riparian vegetation within existing riparian communities. Beneficial effects of enhanced or prolonged baseflow are lower in this alternative than in Alternatives 2 and 3.

In some streams, increased peak flows would potentially cause increased bank erosion and loss of riparian vegetation. This impact would be episodic, rather than ongoing, and would not significantly affect vegetation communities in the long-term.

Terrestrial Species/Habitat Management - Limited site-specific actions to benefit pond turtles, eagles, and woodpeckers would occur in this alternative. Proposed actions would result in reduced understory density and increased vigor of large trees. In the short-term, shade and CWD recruitment would be reduced. Desirable native riparian plant species could become established in areas affected by the proposed action, although conditions favored by reed canary grass could be created in some areas.

Aquatic Species/Habitat Management - Large-scale process-based stream restoration treatments along the river would not occur in this alternative. Site-specific treatments would benefit small areas of riparian vegetation (see Map 27 and Appendix H).

The limited scope of efforts designed to restore the sediment regime at highly visible locations along the river would likely not be sufficient to substantially increase the number or overall extent of point bars or other surfaces suitable for certain types of riparian vegetation. Some existing point bars would increase in size, and riparian vegetation could colonize these sites.

Structures installed in Segment 1 would create features that could support riparian vegetation. Establishment of desired species would be most likely to occur near the wetted edge associated with recreation releases.

Actions designed to reduce width-to-depth ratios would be less extensive than in the Alternatives 2 and 3. Seven sites would be reviewed for potential treatments, which, if implemented, would increase bank stability and the extent of areas with the potential to support riparian communities. Spatial and temporal patterns of floodplain inundation (with both water and sediment) would be restored on a very localized basis, resulting in more diverse assemblages of riparian vegetation species and age classes in certain areas.

Proposed actions designed to reduce the occurrence and inundation frequency of secondary channels would favor the development of riparian communities. Increased channel roughness, reduced frequency flows with sufficient power to scour vegetation, and increased deposition of gravel would create conditions favorable for riparian vegetation.

Limited CWD placement in tributary streams would restore processes that affect vegetation development. Restoration treatments would be focused primarily in reaches of Hayden and Shovel Creek that have been most impacted by past land use. Expected results include increased inundation of floodplains and development of channel features (such as lateral point bars and off-channel wetlands), and would favor establishment of riparian plant species. Planting of desired species (e.g., willow or sedges) that would occur at some treatment sites would enhance riparian communities.

Vegetation Management - *Upland treatments:* Treatments within riparian reserves would affect the availability of sunlight and CWD to wetland and riparian communities. With proposed actions affecting about 25 percent of the acreage within riparian reserves, the extent

of proposed vegetation management actions is less than in Alternatives 2 and 3 but greater than Alternative 1 (see Map 28).

Portions of treatment units are adjacent to small wet meadows along the river, Exclosure and Rock Creek Meadows, and the irrigated meadows in Segment 3. Short-term reductions in small CWD and long-term increases in the availability of large CWD would, in the long-term, benefit these meadows. Along small streams, proposed actions would reduce delivery of small CWD and thereby impair channel-forming processes that create conditions for riparian vegetation establishment.

Riparian treatments: Obliterating roads, and constructing obstructions to OHV would enhance about 19 acres of riparian habitat in nine wet meadows or cattle use. These actions would reduce soil compaction and displacement, reduce the introduction and dispersal of noxious weeds, and improve conditions for development of native vegetation. A small area within Rock Creek meadow that has been impacted by OHV use would be manually de-compacted and revegetated, thereby accelerating recovery of ecosystem functions.

Range Management - Use levels in Segment 3 would decrease slightly relative to current conditions. This would likely improve the health of riparian communities, though not to the degree as would occur in Alternatives 2 and 3. Trampling and consumption of riparian vegetation would continue to detrimentally affect riparian communities associated with springs and upland wet meadows.

Fire and Fuels Management - The existing Fuels Management EA would continue to be in effect in the planning area. The fuels management program in this alternative would be less extensive than Alternative 3 but more extensive than Alternative 1.

Cumulative Effects - Flow regimes proposed in this alternative would enhance riparian communities relative to current conditions, but to a lesser degree than in Alternatives 2 and 3. Peaking operations that would occur during certain periods of some years would continue to alter and/or impair riparian processes.

The extent of instream treatments in Segments 2 and 3 would likely not be sufficient to cause large scale alterations in riparian communities, although proposed flow regimes downstream from the powerhouse would be more conducive to establishment of species other than reed canary grass.

Together, road and vegetation management actions would maintain and restore the processes by which large CWD is supplied to some riparian areas. Increased recruitment and stability of large CWD would lead to development of conditions favorable for riparian vegetation establishment, although the lack of coarse sediment would prevent many of these areas from forming. In other areas, maintenance of roads and campgrounds would decrease large wood supplies to riparian areas.

Irretrievable, Irreversible, and Unavoidable Impacts

In Alternatives 2 and 4, the proposed Shovel Creek Campground (and associated access road) would cause irretrievable adverse effects to riparian vegetation and processes associated with the relic floodplain of the river.

In Alternatives 2 and 4, construction of bridges and boat launches would cause across the river would cause irretrievable adverse effects to small area of riparian vegetation.

In Alternatives 2 and 3, the recommended removal or altered operations of irrigation withdrawals would cause irretrievable adverse affects to riparian vegetation associated with irrigation ditches.

Soils

Soils can be detrimentally or beneficially affected by land management actions. Physical soil properties that may be affected by management activities include bulk density, organic matter content, porosity, and texture. Disturbance that may impact soil properties include compaction, surface mixing and disruption (known as displacement), fire (primarily through loss of soil cover and consumption of organic matter), and soil erosion (Childs et al. 1989).

This discussion will focus on the principal soil series in the planning area (the Bogus, Greystoke, McMullin,, Skookum, Jenny, Lassen, Lithic Haploxerolls, Kuck, and Medford series), since these series account for about ninety percent of the soils in the planning area (see Map 6) . In addition, potential effects to highly productive soils will also be discussed.

Assumptions

The GIS-based component of this analysis relies on the assumption that the characteristics of map units are those of the dominant soil series within that map unit. Because numerous soil series can occur within a single map unit, and these series can have markedly different characteristics, this assumption is not always valid. For the purposes of landscape level analysis, however, the generalization of soil characteristics allows for a relatively straightforward analysis.

Impacts Common to All Alternatives

To ensure protection of soil resources, site-specific characteristics of soils will be considered during project design, and Best Management Practices will be applied to all projects. Of particular concern is susceptibility of soils to detrimental impacts such as compaction, displacement, or surface soil erosion (Table 5-5). Mechanical equipment would not be used when the soil is moist, in order to reduce compaction and puddling. Designating skid trails and using equipment that is appropriate to on-site conditions would limit the extent of soil displacement associated with the use of mechanical equipment. Mechanical equipment would not be used on slopes greater than 35 percent.

Within the Greystoke soil series, 48 acres within the planning area have been classified as fragile non-suitable woodlands under the BLM Timber Productivity Capability Classification system. This inventory classifies timber stands based on their inherent soil properties and landform characteristics. Sites are designated as fragile, non-suitable woodlands if they are judged to be biologically and/or environmentally incapable of supporting a sustained yield of timber. These areas would be excluded for mechanical vegetative treatments due to their occurrence on slopes in excess of 50 percent.

Soil compaction - Soil compaction is the process whereby soil macropores are removed or reduced by physical pressure and vibration of the soil surface, this results in an increase in soil bulk density. These macropores are critical to soil health as they are where soil organisms reside, fine roots of plants reside, and the means by which water infiltration into soil occurs.

Soil compaction and the associated reduction of macropores may occur with all alternatives and is associated with mechanized ground based equipment. Soil compaction may also be negatively effected by both motorized and non-motorized recreation use, which may occur in and around campgrounds, and off highway vehicle trails (OHV). Livestock, and impacts from other large herbivores (horses, elk, and deer) may also compact soil. Both human and large herbivore impacts to soil resources are of particular concern in and around riparian areas and wetlands as these soils are susceptible to compaction and erosion when moist.

Due to past fire suppression, the potential exists for catastrophic wildfires within the planning area. This type of fire would eliminate a high percentage of both vegetative ground cover and organic soil horizons. This would lead to exposed mineral soils and higher levels of surface soil erosion.

Prescribed fire applied to areas through the random selection process and areas selected by the Interdisciplinary Team would reduce hazardous fuel levels, reintroduce fire as an ecosystem process, and thereby promote the development of perennial native plant communities. However, fire directly affects soil by consuming organic matter, altering nutrients, creating water-repellent conditions, decreasing infiltration rates, and removing soil surface cover (Hungerford et al. 1990, DeBano 1990. and Childs et al. 1989). Although fire generally causes short-term effects, where soils are shallow and have low natural fertility or are susceptible to erosion, fire can have a more significant effect on productivity. To reduce surface soil erosion, some areas selected for prescribed burning may require seeding with native perennials to promote a stable soil surface.

Soil displacement - Soil displacement occurs when a portion or all of the surface soil is moved by mechanical action. Displacement can result in the alteration or destruction of surface structure by reducing the amount of pore space and aggregation of individual soil particles. If displacement occurs when soil is wet "puddling" may result, which may create a soil surface that is hard and impermeable when it dries. (Childs et al 1989).

Soil displacement may occur with all alternatives from mechanized ground based equipment, as well as motorized recreational equipment.

Surface soil erosion - Surface soil erosion (including sheet, rill and gully erosion, and dry raveling) is the detachment and down slope movement of individual soil particles or aggregates. It is caused by the energy of rainfall and running water acting on bare soils, or by surface disturbance on steep slopes. Removal of ground cover can greatly increase the potential for surface soil erosion (Baker and Jemison 1991).

Surface soil erosion may be increased in each alternative by any action that removes surface ground cover. This includes actions caused by ground based machinery, motorized and non-motorized recreation, livestock and other large herbivores (horses, elk, and deer), and prescribed fire and wildfires. Erosion is accelerated when these actions occur in and around riparian or wetland resources.

Highly Productive Soils - A small portion (approximately 70 acres) of the planning area in Oregon contains Terrabella clay loam soils, which are prime farmland soils (as defined by the U.S. Department of Agriculture – see glossary). These soils are located in the vicinity of the Hayden Creek, Chert Creek, and Way Creek wet meadows. These soils are highly productive in terms of biomass production and have a potential for high botanical diversity. These are some of the areas where both vegetative and hydrologic restoration efforts would be focused, as well as the establishment of riparian exclosures to help protect riparian resources from livestock. Due to the highly productive nature of these soils, it is thought that restoration of these areas, and protection of these soil resources would provide immense long-term benefits to other resources such as wildlife, cultural, botanical, recreation, and hydrologic function.

Soil Monitoring - A common accepted parameter for measuring the degree of detrimental soil disturbance is change in bulk density or degree of soil compaction that has occurred in an area over pre-project levels. Soil bulk density is the ratio of mass to volume for a given sample of soil and is commonly used as a measure of the compaction of a given soil. The higher the bulk density value, the more compact a soil is. Bulk density is expressed in grams/cubic centimeter (g/cm3).

Under all alternatives, 20% of all ground disturbing activities occurring on the resource area, including the planning area will be quantitatively monitored to determine project effects on soil resources. This monitoring will determine if Best Management Practices were followed for the project, and compliance with RMP and regional soil bulk density and areal ground disturbance standards and guidelines.

Table 5-5.—Susceptibility of major soil map units to detrimental impacts

Soil Map Unit Name	Detrimental Impact				
	Compaction	Puddling	Displacement	Erosion	Slope
Bogus	X	X	X	X	X
Bogus-Skookum	X	X	X	X	
Greystoke stony loam	X	X	X	X	X
Jenny	X	X	X	X	
Lassen-Kuck	X	X	X	X	X
Lithic Haploxerolls				X	X
Medford	X	X	X	X	
Skookum-Bogus	X	X	X	X	X
Skookum-Rock outcrop McMullin	X		X	X	X
Skookum-Rock outcrop-Rubble land	X		X	X	X

Table derived from USDA-SCS 1993, and USDA–1983.

Impacts of Specific Alternatives

(Refer to Maps 6, 13-16, 19a, 21-24, and Appendix H)

Alternative 1

Under this alternative, the potential for ground disturbing activities within the planning area would remain the same as directed by the existing RMPs. The vegetation management and recreation development activities would employ heavy equipment and create a potential for ground disturbing activities and potential soil compaction and/or soil displacement (see Maps 13 and 21). Existing unregulated OHV use at areas such as Frain Ranch would continue under this alternative, this type of recreational use has removed ground cover on this bench and causes surface soil erosion.

Under this alternative, livestock grazing would remain at current levels. Approximately 24 acres of riparian reserves would be excluded from livestock grazing, thus reducing some of the impacts of livestock to soil resources in riparian areas. Decommissioning of approximately 5 miles of existing roads and the subsequent revegetation of these areas would result in less long-term surface soil erosion and area of soil compaction within the planning area. Short-term increases in erosion within these localized areas would occur following these treatments.

Cumulative Impacts - This alternative has the least area of vegetative treatments, riparian reserve livestock exclusion, road decommissioning, hydrologic restoration, and recreation development activities. Under this alternative the short-term impacts to soil resources are small with a potential for long-term negative impacts due to surface soil erosion associated with catastrophic fire, livestock and large herbivore impacts to fragile riparian soils, surface soil erosion associated with current roads, and current soil impacts from unregulated OHV's. However, there are fewer potential impacts from recreation development and associated increased motorized and non-motorized use than under alternative 2 or 4.

Alternative 2

Under this alternative, vegetation treatments would occur over a larger area than Alternative 1 in order to promote the enhancement of Scenic River and ACEC values, primarily scenic and wildlife (see Map 22). Within much of the planning area, mechanical ground based equipment would be employed to accomplish vegetation treatments. Therefore, the potential for detrimental soil impacts including soil compaction, displacement, and surface soil erosion would be more extensive than in Alternative 1, but less extensive than under alternatives with higher levels of ground disturbing management actions.

Impacts from increased recreation use would be greater than Alternative 1 or Alternative 3, but less than Alternative 4 (see Map 14). Livestock grazing would remain at current levels. Approximately 50 acres of riparian reserves would be excluded to livestock grazing, thus reducing some of the impacts of livestock to soil resources in riparian areas. Riparian reserve livestock exclusion is greater than Alternative 1 and 4, but less than Alternative 3. The 370 acres of irrigated meadows in Segment 3 would be managed to restore native plant communities appropriate for the site. Natural patterns of inundation and infiltration would be restored. These lands are currently managed as pasture land, the restoration of these productive lands would potentially benefit soil resources by reducing surface soil erosion. Closure and decommissioning of roads deemed not necessary for management activities would be greater than Alternative 1 or 4, but less than Alternative 3. Ripping and revegetation of these sites proposed as part of road full decommissioning (or obliteration) would lessen long-term impacts of surface soil erosion and soil compaction in these areas. Short-term increases in erosion within these localized areas would occur following these treatments.

Over the long-term the potential for impacts associated with catastrophic fire would be lower than in Alternative 1, since mechanical vegetation treatments would reduce hazardous fuel loads at a higher rate. However, fuel treatments would also emphasize the use of ground based mechanical equipment. The use of this equipment may have short-term detrimental effects on soil resources by increasing soil bulk density over pre-treatment levels.

Approximately 327 acres of the planning area in California contains soils within the Medford series and 174 acres within the Jenny series. These soils area classified as moderate to good agricultural soils (USDA – SCS, 1983). Within Segment 3, approximately 370 acres of land within these soil series are currently utilized as pastureland. Under Alternatives 2 and 3, these irrigated meadows would be managed to restore native plant communities appropriate for the site. Natural patterns of inundation and infiltration would be restored. The restoration of these productive lands would potentially benefit soil resources as well as other resources by reducing surface soil erosion within these fragile sites, and increasing botanical biodiversity.

If PacifiCorp lands in California were acquired or managed by BLM under cooperative agreement, the potential for higher levels of detrimental soil disturbance may increase on these lands, which have restricted public access under current management.

Cumulative Impacts - This alternative has a moderate amount of vegetative treatments, and therefore moderate associated long-term benefits and short-term impacts associated with these treatments. Riparian reserve livestock exclusion is moderate when compared to other alternatives, and would afford moderate protection to fragile riparian and wetland soils and the associated surface soil erosion from livestock stock trampling. The restoration of irrigated pastures to native plant communities would have potential benefits to soil resources through reductions in surface soil erosion of these productive soils. Road decommissioning, hydrologic restoration, and recreation development activities and associated impacts to soil resources are moderate in comparison to other alternatives. Regulated OHV use under this alternative may reduce surface soil erosion and soil compaction associated with this recreational activity.

Alternative 3

Under this alternative, large areas are proposed for vegetation treatments using both mechanical methods and prescribed fire in order to restore the stands to a more historically natural condition (lower fuel loads) and maintain the health of the vegetation (see Map 23). Therefore, this alternative would have a greater risk of potential detrimental soil impacts occurring over a high percent of the planning area. These impacts can be primarily attributed to the emphasis of ground-based machinery, which may increase soil bulk density; and higher erosion levels associated with short-term removal of ground cover by prescribed fire.

Under Alternative 3, little cattle grazing would likely occur, and only to meet other management or restoration objectives. This would reduce if not eliminate soil impacts such as surface soil erosion and soil compaction that may be caused by livestock. Soil impacts would continue to exist in the planning area from wild horses, and other large herbivores such as elk and deer. Approximately 75 acres of riparian reserves would be excluded to remaining livestock, thus reducing some of the impacts to soil resources in riparian areas. However, an indirect impact of no livestock grazing could be an increased danger of wildfire due to a build up of additional fine fuels. Both prescribed fire and wildfire, as mentioned above have the potential to increase surface soil erosion. The 370 acres of irrigated meadows in segment 3 would be managed to restore native plant communities appropriate for the site. Natural patterns of inundation and infiltration would be restored. These lands are currently managed as pasture land, the restoration of these productive lands would potentially benefit soil resources by reducing surface soil erosion.

Under this alternative, riparian and wetland restoration projects would be greater than other alternatives. Restoration of natural hydrological processes in the long-term would benefit soil resources by reducing surface soil erosion. As many of these projects would utilize ground based machinery, impacts to soil resources including soil compaction, soil displacement, and surface soil erosion could be caused in the short-term. Timely rehabilitation of areas with native perennial ground cover would minimize these effects. Under this alternative, road closures, regulations, and decommissioning would be greater than other alternatives. The closure of roads, decommissioning of roads, and subsequent vegetative rehabilitation of roads would have a long-term positive effect on soil resources by reducing soil compaction and reducing surface soil erosion associated with roads. Short-term increases in erosion within these localized areas would occur following these treatments (see Map 19a).

Approximately 327 acres of the planning area in California contains soils within the Medford series and 174 acres within the Jenny series. These soils area classified as moderate to good agricultural soils (USDA – SCS, 1983). Within Segment 3, approximately 370 acres of land within these soil series are currently utilized as pastureland. Under Alternatives 2 and 3, these irrigated meadows would be managed to restore native plant communities appropriate for the site. Natural patterns of inundation and infiltration would be restored. The restoration of these productive lands would potentially benefit soil resources as well as other resources by reducing surface soil erosion within these fragile sites, and increasing botanical biodiversity.

If PacifiCorp lands in California were acquired or managed by BLM under cooperative agreement, the potential for higher levels of detrimental soil disturbance may increase on these lands, which have restricted public access under current management.

Cumulative Impacts - This alternative has the greatest amount of vegetative treatments, riparian reserve livestock exclusion, road decommissioning and regulated use, and hydrologic restoration. Under this alternative the short-term impacts to soil resources are greater than other alternatives due to the use of ground based machinery for vegetation and hydrologic restoration purposes, there is also potential for greater long-term positive soil benefits due to these restoration activities. Negative impacts due to recreation development activities are similar to Alternative 1, with the exception of greater control of OHV's, which would lessen potential negative soil impacts such as surface soil erosion and soil compaction.

Little cattle grazing would likely occur, and only to meet other management or restoration objectives. This would reduce if not eliminate soil impacts such as surface soil erosion and soil compaction that may be associated with livestock. Some animal related soil impacts would continue to exist in the planning area from wild horses, and other large herbivores such as elk and deer. The restoration of irrigated pastures to native plant communities would have potential benefits to soil resources through reductions in surface soil erosion of these productive soils.

Alternative 4

Under this alternative, vegetation treatments would be increased over current levels, but the additional areas treated would be concentrated around roads, high recreation use areas, and in important wildlife habitat (see Map 24). Therefore, the amount of soil resources impacted could be greater than in Alternative 1, smaller than in Alternative 3, and similar to Alternative 2, but distributed differently across the landscape.

Fuel treatments would emphasize use of mechanical equipment; therefore, the potential for detrimental soil conditions including soil compaction, soil displacement, and surface soil erosion would be similar to Alternative 2.

The potential for impacts from vegetation management activities would be similar to Alternative 2 since mechanical treatments would reduce hazardous fuel loads at a higher rate than in Alternative 1. However, the potential for impacts from fire suppression activities and high intensity, canopy-replacing fires would be higher than Alternative 3 where larger areas of both mechanical and prescribed fire habitat restoration activities are proposed.

The more extensive development of recreation sites under this alternative has the potential to increase risk to soil resources (see Map 16). In addition to developed recreation, off highway vehicle recreation would probably increase for the planning area. This could result in higher levels of detrimental soil disturbance including soil compaction, surface mixing and disruption, fire, and surface soil erosion. If PacifiCorp lands in California were acquired or managed by BLM under cooperative agreement, the potential for higher levels of detrimental soil disturbance may increase on these lands, which have restricted public access under current management.

Under this alternative, livestock grazing would be similar to Alternatives 1 and 2. Soil resources would be impacted greater than Alternative 3 and similar to Alternatives 1 and 2. Approximately 40 acres of riparian reserves would be excluded to remaining herbivores, thus reducing some of the impacts to soil resources in riparian areas.

Cumulative Impacts - This alternative has a moderate amount of vegetative treatments, and therefore moderate long-term benefits and short-term impacts associated with these treatments. Under this alternative, hydrologic restoration opportunities are limited and therefore, short-term soil resource impacts and long-term benefits are as well limited. Cattle exclusion in riparian reserves is moderate, and therefore soil resource benefits to fragile wetland soils and reduced livestock trampling would also be moderate. This alternative emphasizes recreational development, with less emphasis on habitat restoration. This alternative would emphasize campground expansion and would improve road surfaces and trail opportunities. Campground expansion would potentially cause an increased risk to soil resources for soil compaction of the immediate area around the campground and surface soil erosion if vegetation ground cover were not managed for these areas. Improved road surfaces may cause less surface soil erosion than current secondary unimproved roads. Due to trail enhancement, reduction in surface erosion may be offset by both expansion and increased use of both motorized and non-motorized trails.

Irretrievable, Irreversible, and Unavoidable Impacts

Development of recreation facilities (campgrounds and trails) would result in an irretrievable commitment of resources. Construction of hardened surfaces such as tent pads, or installation of structures would remove soils from a productive condition. Surfaced or heavily used and maintained trails would result in irretrievable impacts to soil productivity, especially in riparian zones. The impacts from existing and newly constructed roads would be an irretrievable loss of soil productivity.

The amount of area affected by each alternative differs, with Alternative 3 being the least impacting and Alternative 4 having the most irretrievable impacts to soils. These impacts, however, represent small acreages within the planning area for all alternatives.

Terrestrial Species/Habitat (Wildlife Resources)

Assumptions

Effects on wildlife are the same whether the actions occur on public lands or private lands. Therefore, this discussion is not separated out by land ownership, but mention of locations of specific impacts is made when appropriate.

Impacts Common to All Alternatives

Scenery Management - With the exception of vegetation management for fuels/fire control, no actions are planned for improving scenic quality. Other than effects described in the vegetation management section, there would be no direct effects on wildlife. The restrictions on activities due to scenic quality may slow the process of habitat restoration and cause some indirect effects due to this delay. However, most planned wildlife projects can be adapted to these restrictions.

Recreation Facilities and Management - *Campsites w/in riparian reserves (include day use areas, toilets):* Facilities within the riparian reserves maintain or encourage a continued human presence. This human activity may increase disturbance and stress to wildlife. Camping and recreational development in riparian reserves also limits available habitat for aquatic and riparian dependant species due to some species avoiding the disturbance caused by human activity. This directly affects species that nest or live in the riparian zone but also may affect species such as the bald eagle, osprey, or otter that forage along the river. Human activity may cause alteration in feeding activity or total avoidance of certain areas. This can be localized to an individual campsite such as increased use by magpies and other scavenging species or result in the avoidance of the entire campground by foraging big game species. Human use may also have indirect impacts to wildlife due to soil compaction or trampling of vegetation.

Maintaining or developing campsites and recreation areas may have an effect on pond turtle nesting habitat. Turtles use deep soil areas with mild slopes adjacent to water habitats to lay their eggs. A hole is excavated in the soil by the turtle and the eggs are laid and then covered. The heat from the sun hatches the eggs and the young travel across land to the water. These potential turtle nesting areas are the same areas preferred for recreational development, due to proximity to water and ease of development. Compaction caused by human and vehicular traffic would decrease areas that allow excavation by turtles. Development of parking or tent

pads, placement of buildings, signs and/or parking bumpers would remove potential nesting habitat and create additional obstacles for the young turtles on their way to the water. Maintaining screening cover and other vegetation between sites would have an indirect impact on the nesting habitat for pond turtles by keeping sun off of the soil and thus not heating the eggs under the soil.

Abundant screening cover between sites may have a mitigating affect on land-birds and small mammals by maintaining escape and foraging habitat.

Trails: Development of trails has a potential to cause disturbance to wildlife and destruction of habitat. Use of the trail would increase the number of wildlife encounters and resultant displacement or disturbance of wildlife. The amount of this disturbance or stress would vary by frequency of use, type of traffic, and amount of noise accompanying the use on the trails. Foot use would have less noise but may have a longer duration of disturbance. Wildlife often react more physically to disturbance from humans on foot. People walking by often causes animals to move quickly out of the area, whereas the animals may just remain motionless or 'freeze' while a vehicle passes by and then slowly move away from the trail. The 'Freezing' is also an emotional stress with heightened awareness and increased heart rate. Although the vehicle traffic may not have as much localized affects, the vehicle traffic can cover more ground in a given time period so the area disturbed and number of animals displaced could be greater.

Loss of habitat would result from construction of the trails through removal of vegetation and compaction of the tread area. Reduction in quality and use of certain habitats results from repeated human disturbance.

Upland trail development (foot or OHV trails) would increase the potential for disturbance to wildlife throughout the canyon areas. This disturbance would result in short term stress and displacement, but would be less critical than the disturbance in the riparian zones as there would still be adequate wildlife escape cover. The total effect of the disturbance would depend on season of disturbance or importance of habitat. Disturbance that occurs during critical periods such as nesting or wintering periods would have greater effects on each particular animal. Effects would become greater if the trails are near important nesting or foraging areas. Many of the existing and proposed trails in the planning area are located in the riparian areas of the Klamath River. This is a very important habitat type in the Klamath River Canyon.

As trails age and use patterns become more routine the affect of the disturbance may moderate as some animals become acclimated to the use patterns. However this acclimation is a long-term process.

Boating facilities: Launch facilities have continuing impacts to aquatic systems by disrupting the natural connectivity within the riparian reserves and limiting development of riparian vegetation. The impacts of boat ramps/launch facilities mainly occur during the construction phase due to the removal of vegetation and the presence of heavy equipment during the installation phase. The removal and loss of habitat could be important if the habitat is limited or location is in or near critical habitat (i.e. nest sites, dens, etc.)

Indirect impacts would result because the boat ramps would attract more water based activity and this would cause increased disturbance to water dependant species such as pond turtles, wading birds, otters, etc. Pond turtles need extensive sunning periods for development of eggs. Repeated disturbances increase time needed for clutch development and reduce clutch size.

Boat launch facilities could have some beneficial effects. They create good basking areas for waterfowl, pond turtles, and shore birds. However, the benefits are only realized when not used by recreationists for long periods of the day.

Upland recreation sites and interpretive sites: Facilities encourage continued human presence. This human activity may increase disturbance and stress to wildlife. Human activity may cause alteration in feeding activity or total avoidance of certain areas. This can be localized to individual sites such as increased use by magpies and other scavenging species, or result in the avoidance of the entire area by foraging big game species. Human use may also have indirect impacts to wildlife due to soil compaction or trampling of vegetation preferred by wildlife.

Development of campsites and recreation activities in the uplands may attract people away from riparian zones. This could reduce the impacts adjacent to the river.

Abundant screening cover between sites may have a mitigating affect on land-birds and small mammals by maintaining escape and foraging habitat.

Whitewater and motorized boating: Activities on the water create a major disturbance to wildlife that rely on the open water habitats. Boats are more visible, create more disturbance, and cover more area than activities on shore.

Firearm use restrictions: Restrictions on firearm use would have little affect on wildlife populations. The occasional firearm discharge is generally associated with road or trail usage. Impacts from use of roads will be discussed under the roads sections.

Most firearm use is related to shooting at non-animate targets or regulated game populations or varmints or ground squirrels. Occasional removal of individual animals would have a negative impact on those animals but would have little negative effect or possibly a beneficial effect on the population.

Cultural Resource Management - *Historic site preservation:* Historic structures provide a variety of man-made wildlife habitats. This ranges from hiding places for mice, woodrats, raccoons, etc. to nesting or roosting structures for birds and bats.

Interpretive panels/outreach: These types of programs and structures could attract additional people to the area. This would increase the potential for disturbance to wildlife.

The panels could be adapted to provide nesting or roosting areas for bats and birds. The panels and brochures could also be used to educate the public on ways to reduce impacts to wildlife while enjoying the cultural resources.

Vegetation Management - Restoration of natural communities would have a beneficial effect on most wildlife. Since many communities are outside the natural range of conditions, the faster that the fuel loads are reduced and fire is returned to the system the better for wildlife.

Short term disturbance and displacement would occur during the treatment phase. More disturbance would occur during the mechanical treatments since more acres would be treated in a given time period.

Duration of the displacement would depend on the speed in which vegetative recovery occurs. Some species (bluebirds, quail, etc.) would respond immediately while others (such as woodpeckers, deer, etc.) would respond as the vegetation starts to produce better mast crops or higher quality browse.

Terrestrial Species/Habitat Management - Projects designed to benefit particular species or types of wildlife may occasionally have negative impacts to the species' counterpart. Shrubfield species would be impacted when areas are treated to improve meadow habitat or improve conditions for early seral species. A good mix of all types of seral stages within the vegetative communities would be beneficial to all wildlife species.

Watershed Management Actions - *Riparian restoration:* Vegetation manipulation in riparian reserves would have short-term negative impacts due to disturbance or habitat alteration. This would be of very short duration since riparian zones recover vegetation quickly. If riparian vegetation becomes too dense, it could have a negative impact on turtles or other wildlife that need to cross riparian reserves. This could be alleviated by continued management of the vegetation to provide a mix of seral stages Projects proposed under the wildlife and vegetation sections would benefit pond turtle habitat. Improvement of riparian habitat would have a beneficial effect on wildlife especially riparian dependant species. Since the riparian habitat is a scarce commodity, any improvement would be beneficial.

Meadow restoration: Meadows are unique habitat features that need to be managed for a variety of wildlife species. Special emphasis is placed on maintaining wet meadows even if they are man-made, due to the importance of this habitat type. Most proposals involve removing roads or adding fencing to protect meadows.

Aquatic Species/Habitat Management - *Alteration of instream flows (including temperature):* Stream flows that would increase fish populations would be very advantageous to eagles, osprey, kingfishers etc. Flow fluctuations and timing of these fluctuations could affect feeding opportunities for wildlife. If high flows are limited and are used heavily by rafters, then feeding opportunities would be limited during high flows. Pond turtles need adequate time to sun during the day for egg production. If flows are irregular or changing during this period the turtles may not get adequate time for egg development. Current peaking operations result in a lack of riparian vegetative encroachment, normalizing channel widths, and wide temperature variations. Projects that would benefit fisheries would be beneficial to wildlife species, especially those that feed on similar invertebrates or on the fish.

Ladder attraction flows, bypass out flows, emergency water release chute: These actions have very little potential to affect wildlife. They would be beneficial to those wildlife species that feed on similar invertebrates or on the fish.

Instream structures (wood/rock, side channel/chute cutoff treatments, bridge sites, and width treatments): Development of a stream channel with deeper pools and side channels would be beneficial to wildlife. The side channels, especially if developed with deep pools, would be great refugia areas away from most human disturbance. The alternatives with more proposed stream improvements would result in greater benefits to wildlife.

Range Management - Well managed grazing would have minimal effects on wildlife and may have some beneficial effects such as removing decadent growth on grasses and stimulating regrowth. Current BLM livestock grazing management systems and levels in Segments 1 & 2 have proven to be compatible with wildlife and their habitat.

In Segment 3, nearly all of the livestock grazing occurs on private lands (primarily PacifiCorp). The livestock management is more intense and grazing occurs in some areas year around. Grazing livestock can create conflicts with wildlife species for forage. PacifiCorp would determine the intensity and level of livestock use and impacts would remain unless the cooperative agreements are developed as proposed under Alternatives 2-4.

Fire and Fuels Management - Wildlife species evolved with fire as a natural process in developing habitats. Lack of fire has resulted in many “dis-climaxes” or individual plant species having unnatural population levels due to unnatural conditions. For example, white fir has become predominant in many mixed conifer stands and juniper is taking over numerous pine stands and meadow areas. This invasion of natural plants in unnatural situations or numbers has also resulted in a shift in wildlife species and numbers. Returning fire to the ecosystem would have beneficial impacts to wildlife habitat. There may be some disturbance or short-term impacts on wildlife but long-term impacts would be beneficial.

Land Tenure - Blocking up ownership in an area or combining ownerships under a single cooperative management agreement allows more consistent and easier management of an area. This consistent management scheme would be beneficial to wildlife management. This is especially important on winter ranges, or other management of critical habitats.

Impacts of Specific Alternatives

(Refer to Maps 7, 13-16, 17a-20a, 21-24, 27-28, and Appendix H)

Alternative 1

Recreation Facilities and Management - *Campsites w/in riparian reserves (include day use areas, toilets):* As recreation sites are developed and improved, the level of impacts would increase. Under Alternative 1, the impacts would not change much since the development would be limited to the existing areas and the level of human activity would remain as is or increase slightly. The enhancement and development of new designated dispersed recreation facilities would have the least negative impact on terrestrial wildlife in this alternative when compared to the other alternatives (see Map 13). For riparian wildlife species, like the pond turtle, negative impacts would still continue at existing recreation facilities.

Trails (Include fishing access pts, rapids scouting, and to interpretive sites): No additional trails would be constructed under Alternative 1. Turtle camp trail, recently re-opened by recreation OHV users, would be reestablished as a non-motorized trail. The use of this trail for vehicular use has impacted the meadow, reducing meadow vegetation and increased compaction. Restoration of the Turtle Camp trail to a non-motorized trail would be beneficial to wildlife, as it would allow recovery of the impacted meadow.

When compared to the other alternatives, Alternative 1 would cause the least impact to wildlife from the construction of non-motorized trails and use of designated OHV routes. The greatest negative impact from motorized trails occurs in Alternative 4.

Boating facilities: Limited improvements to some recreation facilities may occur, however, no additional facilities would be constructed. These facilities are having continued minor impacts on aquatic systems by disrupting the natural connectivity within the riparian reserves and limiting development of riparian vegetation.

Upland recreation sites and interpretive sites: Use of the old housing site at J.C. Boyle powerhouse is proposed to continue as a bus/RV/overflow parking for the nearby boat launch. Although in an already massively altered site, this is an important denning area for herptiles, which could be negatively affected by continued use.

Whitewater and motorized boating: As recreation use is developed, more impacts are expected. Alternative 1 is not expected to develop the boating activities to a point where the disturbance becomes a major problem for wildlife.

Firearm use restrictions: Restrictions placed on firearm use due to campgrounds, trails, or other human activity could reduce the effectiveness of population control through hunting. This is not expected to be a problem under Alternatives 1, 2, or 3.

Road Management - *Road treatments (decommissioning/closures, improvements):* Under Alternative 1, minimum treatments (spot improvements) would be implemented in order to maintain existing roads or to meet ACS objectives (see Map 17a). Road densities may be reduced under this alternative but only to a limited degree. Road closures would usually result from some other action that is occurring in the canyon. Some roads removed from the base would be converted to hiking trails. For the most part, those impacts occurring to wildlife from roads within the Planning area would continue.

Some roads such as the powerline roads would be designated 'regulated use'. This would reduce the use of these roads by the general public, especially during important time periods, which would reduce disturbance to wildlife.

Culvert installations: Installation or removal of culverts has the potential for some short-term disturbance to wildlife and destruction of habitat due to equipment usage. Culverts can be used by herptiles and small mammals as hiding areas for safer passage from one side of the road to the other.

Cultural Resource Management - Historic site preservation and maintenance of old structures would continue to provide the manmade habitats that certain species of wildlife have adapted to using (see Map 4 and Appendix H).

Vegetation Management - Vegetation treatments would continue based on existing management for the Scenic corridor of the Planning area, typically out of river view. Upland vegetation treatments would be limited in size and location due to existing management. Indirect impacts may result from increased road traffic on marginal road surfaces within the Planning area (see Map 21).

This alternative enhances terrestrial and riparian wildlife habitat by implementing some vegetation treatments and fuel load reduction projects. However, this alternative provides for least in maintaining the diversity in vegetation needed to sustain diverse wildlife species. The greatest benefits to wildlife habitat from vegetation treatments occur in Alternative 3.

Terrestrial Species/Habitat Management - Fuel reduction and vegetation treatments around large trees and in riparian zones is minimal in this alternative, but would benefit eagle and osprey nest sites by reducing potential for catastrophic wildfire. These projects would also benefit pond turtles and other species that need more open riparian habitat.

Existing and additional man-made nest structures would provide more perch and nest sites for species such as for wood ducks, raptors, robins, and swallows.

Vegetation management of some of the oak stands would improve mast crops for turkeys, deer, certain woodpeckers, bluebirds, etc. Even though these treatments are limited in acreage, (~ 20% of BLM oak stand acres in Segment 2), the treatment areas identified are some of the highest used deer winter range units in the canyon. Beneficial impacts to wildlife from treating these units would be moderate.

Watershed Management Actions - *Riparian restoration:* (Refer to the discussion in Impacts Common to All Alternatives.) When compared to the other alternatives, Alternative 1 provides fewest watershed improvements projects and would have the fewest positive impacts to wildlife. The greatest benefits for wildlife habitat from watershed actions occur in alternative 3.

Meadow restoration: (Refer to the discussion in Impacts Common to All Alternatives.)

Aquatic Species/Habitat Management - *Alteration of instream flows (including temperature):* (Refer to the discussion in Impacts Common to All Alternatives.) No changes in the flow regimes would be pursued as part of Alternative 1. This would result in continued impacts to the aquatic ecosystem from existing operations. Current lack of riparian vegetative encroachment, and normalizing channel widths, due to peaking operations would continue. The lack of available riparian vegetation would continue to be a limitation for the aquatic wildlife species in the planning area. Heavy recreation use during higher summer flows would have a disturbance impact to wildlife.

Ladder attraction flows, bypass out flows, emergency water release chute: Very little work is planned under this alternative except for some stabilization at the release chute. No impacts to wildlife are expected.

Instream structures (wood/rock, side channel/chute cutoff treatments, bridge sites, and width treatments): In-stream structures would not be placed as part of Alternative 1. Existing channels would be anticipated to remain largely in their existing over-widened conditions. Some lateral erosion sites within Segments 1 and 3 would continue to move until reaching a geomorphic limitation such as bedrock. Fisheries access to side channels (chute cutoffs) would not be changed under this alternative.

Range Management - Well managed grazing would have minimal effects on wildlife and may have some beneficial effects such as removing decadent growth on grasses and stimulating regrowth.

Under Alternative 1, the area in Segment 2 would be managed as part of the Ward pasture. Under current management this pasture would be managed to protect or enhance big game winter range. As such it would receive limited use in early spring and occasionally a short fall use period.

Fire and Fuels Management - Alternative 1 proposes to treat fuels reduction on a random process, which would be a slow reintroduction of fire to the ecosystem. This process would take a long time to affect the recovery of current conditions.

Land Tenure - Land acquisition as described in the Klamath Falls and Redding Ramp's would be implemented under Alternative 1, little or no other acquisition would be pursued. No land conservation easements would be pursued as part of this alternative. The ability to administer the lands within the Klamath River planning area would generally remain as is. Alternative 1 results in a higher risk of development of riparian lands within Segment 3, which may result in adverse impacts riparian dependant species.

The largest potential for negative impact to wildlife would be if the existing private lands were subdivided and developed. Alternative 1 results in a higher risk of development of riparian lands within Segments 2 and 3, which may result in adverse impacts to riparian dependant species.

Cumulative Impacts - Overall there are few negative cumulative impacts and some positive impacts to wildlife in this alternative when compared to the other alternatives.

Few new recreation facilities are proposed in this alternative, which provides the least negative impacts to riparian associated wildlife when compared to the other alternatives.

New non-motorized trails would be constructed to provide additional recreation access in project boundary area where human activity has not occurred. This would be a slight negative impact to wildlife from increased encounters with people. The negative impacts from non-motorized trail activity in this alternative would be greater than the motorized activities due to the longer periods of time that wildlife would be exposed to people. The greatest negative impact to riparian and terrestrial wildlife would occur in Alternative 4.

In this alternative wildlife habitat would have limited long term positive benefits from the vegetation treatments proposed. However, the benefits to wildlife would not be as great when compared to Alternative 3.

Watershed improvements projects would have a positive benefit to wildlife habitat in Alternative 1. The greatest benefits for wildlife habitat from watershed actions occur in Alternative 3.

The largest potential for high long-term negative impacts to wildlife would result on private lands that could be subdivided and developed in river Segment 3 when compared to the other alternatives.

Alternative 2

Recreation Facilities and Management *Campsites w/in riparian reserves (include day use areas, toilets):* Under Alternative 2 the increased recreational use levels at campsites within riparian areas would increase the disturbance to wildlife in the riparian areas (see Map 14). Wildlife avoidance of areas adjacent to these sites would increase. Acres of impacted habitat would increase due to increased use and more areas developed. - Enhancement and development of new designated dispersed recreation facilities would provide negative impacts to wildlife especially where pond turtle habitat is limiting. Relocating one group site at Turtle camp would help provide some additional habitat for turtles. The development of the new Beswick campground in Segment 3 would disrupt wildlife movements and eliminate some habitat when compared to Alternative 1. Locating the campground near Shovel Creek would have further impacts to riparian habitat important for wildlife.

Trails (Include fishing access points, rapid scouting, and to interpretive sites): Trail development and usage would increase under Alternative 2. This would allow increased disturbance to wildlife. Since most of the trail development is planned in riparian zones the impact would be greater due to loss of this important habitat. The construction of nonmotorized trails in this alternative would have moderate negative impacts to wildlife, especially in riparian areas. The most negative impacts to wildlife dependent on riparian habitat occur in Alternative 4.

Boating facilities: Limited improvements to some recreation facilities may occur, however, no additional facilities would be constructed. These facilities are having a minor continued impact to the aquatic system by disrupting the natural connectivity within the riparian reserves and limiting development of riparian vegetation. Maintaining existing facilities within the riparian reserves maintains a limited vegetative community at the sites. Recreational development in riparian reserves limits available habitat for aquatic and riparian dependant species.

Upland recreation sites and interpretive sites: Development of an interpretive site at J.C. Boyle powerhouse is proposed within an already massively altered site. This area is an important denning area for herptiles. Development at this site could increase wildlife and human encounters. Installation of an interpretive site and parking area is not anticipated to have additional impacts to terrestrial habitat. Landscaping this area for the interpretive site could have beneficial impacts by providing additional vegetation for landbirds. Interpretive sites on Topsy grade if appropriately sited (i.e., outside of drainage bottoms) would not be anticipated to affect the aquatic habitats within the canyon.

Whitewater and motorized boating: Disturbance could result in displacement from feeding areas for wading birds, eagles, otter, etc. Pond turtles require several hours of sunning for egg development. Repeated disturbance could prevent this egg development.

As recreation use is developed, more impacts are expected. More use is expected under Alternative 2, which could affect wildlife through continued disturbances. Alternatives 1 and 3 are expected to develop the boating activities to a lesser degree.

Firearm use restrictions: Restrictions placed on firearm use and hunting activities due to campgrounds, trails, or other concentrated human use areas, could reduce the effectiveness of population control through hunting. This is not expected to be a problem under Alternatives 2.

Road Management - Additional roads and road improvements are planned under Alternative 2 so impacts from increasing human use would be greater. Proposed road closures would accelerate a reduction in wildlife disturbance. Decommissioning of approximately 10.5 miles of roads are proposed under this alternative for Segments 1 & 2. However, in Segment 3, three miles of additional roads would be open to the public. This alternative opens the

PacifiCorp lands in California to designated OHV tour routes. These lands were closed to the public in Alternative 1. Negative impacts to wildlife would be moderate from noise and vehicle traffic. The greatest negative impact from motorized trails occurs in Alternative 4.

Cultural Resource Management - Historic site preservation: Maintenance of old structures would continue to provide the manmade habitats that certain species of wildlife have adapted to using. Restoration or renovation could enhance these opportunities as long as the restoration occurs with natural products. Installing metal roofs or plastic siding would have a negative effect on the use of these structures as habitat (see Map 4 and Appendix H).

Vegetation Management - Alternative 2 would have more treatment units proposed. These treatment units would concentrate on little seen areas in the uplands in segment 2 and the river corridor in segment 2 and 3 (see Map 22). Species that use riparian habitat would be benefited. Upland species in Segment 3 would receive very few benefits from vegetative treatments. This alternative enhances terrestrial and riparian wildlife habitat by implementing more vegetation treatments and fuel load reduction projects when compared to Alternative 1. This alternative provides for maintaining the diversity in vegetation needed to sustain diverse wildlife species, however, the greatest benefits to wildlife habitat from vegetation treatments occur in Alternative 3.

Terrestrial Species/Habitat Management - Existing and additional man-made nest structures would provide more perch and nest sites for wood ducks, raptors, robins, swallows, and similar species than Alternative 1.

Vegetation management of some of the oak stands would improve mast crops for turkeys, deer, certain woodpeckers, bluebirds, and other species that depend on these crops. Even though these treatments are limited in acreage, (~ 20% of BLM oak stand acres in segment 2), the treatment areas identified are some of the highest used deer winter range units in the canyon. Beneficial impacts to wildlife from treating these units would be high.

Additional fuel reduction and vegetation treatments around large trees and in riparian zones would benefit eagle and osprey nest sites by reducing potential for catastrophic wildfire. These projects would also benefit pond turtles and other species that need more open riparian habitat. More riparian areas would be treated under this alternative than Alternative 1.

Additional structures would be installed on buildings and around campgrounds to create more perch and nest sites to benefit species such as wood ducks, raptors, robins, and swallows. Structures would also be created in trees to add potential nest sites for eagles and osprey.

Management treatment areas in all vegetation types are proposed. Some treatment areas are recommended for PacifiCorp land. These proposed units would improve the variety of seral stages available and benefit wildlife by providing more opportunities for wildlife use. The units would also be scattered throughout the canyon area so they would benefit more individuals. Thirty-four percent of the oak stands would be treated to improve mast crops for turkeys, deer, certain woodpeckers, bluebirds, etc. Timber stands would be treated (~ 40 %) to reduce fuel loads and density. This would improve forest health yet maintain all habitats, especially nesting, roosting, foraging habitat for spotted owls. Brush fields would be rejuvenated to provide improved habitat for big game and land birds.

Releases of turkeys and peregrines proposed under this alternative would allow these species to take advantage of additional habitats. This would benefit the populations as a whole.

Watershed Management Actions - *Riparian restoration:* Revegetation of the decommissioned roads in riparian zones would be beneficial to wildlife and habitat. The removal of roads adds more habitat area and the revegetation speeds the recovery process. Watershed improvement projects would have a greater positive benefit to wildlife habitat in

Alternative 2 as compared to Alternative 1. The greatest benefit for wildlife habitat from watershed actions occurs in Alternative 3.

Blackberry eradication along streams and roads is proposed under Alternatives 2 and 3. In areas where the blackberries are preventing natural riparian vegetation from occurring, this removal could allow more vegetation diversity to develop and thus be a positive influence on habitat. However, blackberry clumps provide escape cover and food for many species of birds and small mammals. Blackberries are also a major seasonal food item for black bears and land birds in late summer, and elk during late fall and winter. Removal of these bushes would have an overall negative effect on wildlife.

Meadow restoration: Most of the dry and wet meadows on BLM would be treated under this alternative, which would provide improved forage and habitat for big game, upland game, non-game birds, and others.

Aquatic Species/Habitat Management - *Alteration of instream flows (including temperature):* Under Alternative 2 the base river flows would be increased resulting in less fluctuation of total flow. These more consistent flows would improve the riparian habitat for wildlife. It would also benefit the foraging and resting habitat for aquatic species. This alternative is close to the current situation. These flows would have little effect on species that are compatible with these flows such as small shorebirds. However, this would result in continued impacts to the aquatic ecosystem from existing operations. Eagle foraging areas, pond turtle sunning opportunities would be negatively affected.

Instream structures (wood/rock, side channel/chute cutoff treatments, bridge sites, and width treatments): Under Alternative 2, areas would be reviewed and problem areas would be restructured to prevent fish stranding and create deeper pools in the side channels. There would be short-term impacts while the construction work is being completed. However, most of this type of work would be done in late summer during low flows. That time period coincides with the period of time for least wildlife conflicts.

Range Management - If PacifiCorp lands were placed under a cooperative management agreement or federal management, the livestock use would be adjusted to benefit other resources, including wildlife. Under Alternatives 1, 2, and 4 the area in segment 2 would be managed as part of the Ward pasture. Under current agreements this pasture would be managed to protect or enhance big game winter range. As such it would receive limited use in early spring and occasionally a short fall use period.

Fire and Fuels Management - Alternative 2 proposes more vegetation treatments in which fuel reductions are part of the treatment. This alternative would be more advantageous to wildlife than Alternative 1.

Land Tenure - The greatest potential for long term negative impact to wildlife would be if the existing PacifiCorp lands were subdivided and developed. In Alternative 2, the potential would exist to enter into a long-term cooperative management agreement with PacifiCorp or acquire their lands within the project alternative boundary within river Segments 2 and 3. A long-term cooperative management agreement between BLM and PacifiCorp throughout the river canyon would provide a positive benefit for wildlife. However, if PacifiCorp's lands were sold to developers this could provide a negative impact to terrestrial and riparian wildlife species. The acquisitions possible under Alternatives 2, 3 and 4 would have the potential to provide long-term positive impacts for habitat management for all wildlife species in the alternative project boundary areas.

Cumulative Impacts - Overall there are few negative cumulative impacts and some positive impacts to wildlife in this alternative when compared to the other alternatives.

New recreation facilities are proposed in this alternative, which provides moderate negative impacts to riparian and terrestrial associated wildlife when compared to Alternatives 1 and 3. The proposed Beswick Recreation Site would disrupt wildlife movements and eliminate some habitat along the river in Segment 3, when compared to Alternative 1. Relocating one recreation site (in river Segment 2) would be a positive impact by providing some additional riparian habitat for turtles.

New non-motorized trails would be constructed to provide additional recreation access in the project boundary area where human activity has not occurred. This would be a moderate negative impact to wildlife from increased encounters with people. The negative impacts from non-motorized trail activity in this Alternative would be greater than the motorized activities due to the longer periods of time that wildlife would be exposed to people. The greatest negative impact to riparian and terrestrial wildlife from non-motorized and motorized trail activities would occur in Alternative 4.

In this alternative wildlife habitat would have long term positive benefits from the vegetation and fuel load reduction treatments proposed. However, the benefits to wildlife would not be as great when compared to Alternative 3.

Watershed improvement projects would have a positive benefit to wildlife habitat in Alternative 2. The greatest benefits for wildlife habitat from watershed actions occur in Alternative 3.

Long-term negative impacts to wildlife would result on PacifiCorp lands that could be sold and subdivided in river Segments 2 and 3 when compared to the other alternatives. Entering into a long-term cooperative management agreement between BLM and PacifiCorp to provide consistent vegetation and wildlife management in the river canyon would provide long-term positive benefits to riparian and terrestrial wildlife species.

Alternative 3

Recreation Facilities and Management *Campsites w/in riparian reserves (include day use areas, toilets):* Enhancement and development of new designated dispersed recreation facilities would create negative impacts to wildlife especially where pond turtle habitat is limiting. Relocating one group site at Turtle camp would help provide some additional habitat for turtles Alternative 3 would have the least impacts to wildlife from recreation management actions since several campsites would be removed or scaled down (see Map 15).

Trails (Include fishing access points, rapid scouting, and to interpretive sites): The construction of nonmotorized trails has moderate negative impacts to wildlife, especially in riparian areas. Alternative 3 would have the least amount of impacts from these actions because many of the trails would be closed and human use would be reduced. The most negative impacts to wildlife dependent on riparian habitat occur in Alternative 4.

Boating facilities: Limited improvements to some recreation facilities would still occur in this alternative, however, no additional facilities would be constructed. These facilities are having continued minor impacts on aquatic systems by disrupting the natural connectivity within the riparian reserves and limiting development of riparian vegetation. Maintaining existing facilities within the riparian reserves maintains a limited vegetative community at the sites. Recreation development in riparian reserves limits available habitat for aquatic and riparian dependant species

Upland recreation sites and interpretive sites: Development of an interpretive site at J.C. Boyle powerhouse is proposed within an already massively altered site. This area is an important denning area for herptiles. Development at this site could increase wildlife and human encounters. Installation of an interpretive site and making parking available to the public is not anticipated to have additional impacts to terrestrial habitat. Landscaping this

area for the interpretive site could have beneficial impacts by providing additional vegetation for landbirds. Interpretive sites on Topsy grade if appropriately sited (i.e., outside of drainage bottoms) would not be anticipated to affect the aquatic habitats within the canyon.

Whitewater and motorized boating: As recreation use decreases, less disturbance impacts are expected. Alternative 3 is expected to generate the fewest boating activities thus the disturbance impacts are minor.

Firearm use restrictions: Restrictions placed on firearm use and hunting activities due to campgrounds, trails, or other concentrated human use areas, could reduce the effectiveness of population control through hunting. This is not expected to be a problem under Alternatives 3.

Road Management - *Road treatments (decommissioning/closures, improvements):* Several road closures are planned under Alternative 3 and this alternative would have the least miles of open road per section especially in Segment 2, resulting in the greatest benefit to wildlife (see Map 19a and 19b).

Cultural Resource Management - *Historic site preservation:* Maintenance of old structures would continue to provide the manmade habitats that certain species of wildlife have adapted to using. Restoration or renovation could enhance these opportunities as long as the restoration occurs with natural products. Installing metal roofs or plastic siding would have a negative effect on the use of these structures as habitat (see Map 4 and Appendix H).

Vegetation Management - In Alternative 3, the vegetative treatments would occur throughout the planning area to the greatest extent of any alternative. These treatments would be beneficial to all types of wildlife.

Terrestrial Species/Habitat Management - Emphasis on returning the communities to natural conditions would down play the use of nest structures. This would result in fewer opportunities to use man-made structures. However, more natural structures may be available due to improved tree stand composition and structure.

Management of areas in all vegetation types would be maximized under this Alternative. This would provide the most benefits for wildlife. Some species dependant on dense timber stands, such as spotted owls in Negro Creek, would be negatively affected due to reduction in quality of habitat.

Riparian areas would be managed heavily to return them to more natural conditions. This would be the best alternative to get quick recovery of the riparian areas for wildlife habitat. Irrigated fields would be converted to wet meadows through passive irrigation from ground water or use of canal systems. These wet meadows are a scarce resource so improvement or maintenance of these meadows, even though not totally natural would be a benefit to riparian species.

Watershed Management Actions - *Riparian restoration:* The benefits from this activity would increase through the alternatives with the most benefits from Alternative 3. Revegetation of the decommissioned roads in riparian zones would be beneficial to wildlife and habitat. The removal of roads adds more habitat area and the revegetation speeds the recovery process. These actions are proposed under all alternatives, however, they occur more frequently under Alternative 3 and provide the most benefits.

Blackberry eradication along streams and roads is proposed under Alternative 3. In areas where the blackberries are preventing natural riparian vegetation from occurring, this removal could allow more vegetation diversity to develop and thus be a positive influence on habitat. However, blackberry clumps provide escape cover and food for many species of birds and small mammals. Blackberries are also a major seasonal food item for black bears and land birds in late summer and elk during late fall and winter.

Meadow restoration: Treatment of dry and wet meadows on BLM proposed under this alternative would provide improved forage and habitat for big game, upland game, non-game birds, and others. Alternative 3 would result in the greatest benefits for wildlife habitat from watershed actions.

Aquatic Species/Habitat Management - *Alteration of instream flows (including temperature):* Alternative 3 proposes a more natural flow with normal seasonal peaks, etc. This would be beneficial for natural development of riparian habitat but may have negative impacts on some species or population numbers that rely on the consistent late summer flows.

Instream structures (wood/rock, side channel/chute cutoff treatments, bridge sites, and width treatments): The amount of this in-stream structure work would be maximized under Alternative 3 to restore the river to natural conditions. There would be short-term impacts while the construction work is being completed. However, most of this type of work would be done in late summer during low flows. That time period coincides with the period of time for least wildlife conflicts (see Map 27).

Range Management - If PacifiCorp lands were placed under a cooperative management agreement or federal management, the livestock use would be adjusted to benefit other resources, including wildlife. Alternative 3 would result in the least impact on wildlife from livestock grazing.

Fire and Fuels Management - Under Alternative 3, fire would be an integral part in restoration of the ecosystem. The long-term beneficial impacts from fire treatments would be positive for all wildlife.

Land Tenure - The greatest potential for long-term negative impact to wildlife would be if the existing PacifiCorp lands were subdivided and developed. In Alternative 3, the potential would exist to enter into a long-term cooperative management agreement with PacifiCorp or acquire their lands within the project alternative boundary within river Segments 2 and 3. A long-term cooperative management agreement between BLM and PacifiCorp throughout the river canyon would provide a positive benefit for wildlife. However, if PacifiCorp's lands were sold to developers this could provide a negative impact to terrestrial and riparian wildlife species.

The acquisitions possible under Alternatives 2, 3 and 4 would have the potential to provide long-term positive impacts for habitat management for all wildlife species in the alternative project boundary areas.

Cumulative Impacts - Overall Alternative 3 provides the most positive benefits to wildlife when compared to the other alternatives. Recreation facilities and activities are generally de-emphasized in this alternative reducing the conflicts with wildlife.

Some new recreation facilities are proposed in this alternative, which provides moderate negative impacts to riparian and terrestrial associated wildlife when compared to Alternatives 1, 2 and 4. The proposed Beswick Recreation Site would disrupt wildlife movements and eliminate some habitat along the river in Segment 3, when compared to Alternative 1. Relocating some recreation sites (in river Segment 2) would be a positive impact by providing some additional riparian habitat for turtles. The most negative impacts to wildlife dependent on riparian habitat occur in Alternative 4.

New non-motorized trails would be constructed to provide additional recreation access in the project boundary area where human activity has not occurred. This would be a moderate negative impact to wildlife from increased encounters with people. The negative impacts from non-motorized trail activity in this Alternative would be greater than the motorized activities due to the longer periods of time that wildlife would be exposed to people. The

greatest negative impact to riparian and terrestrial wildlife from non-motorized and motorized trail activities would occur in Alternative 4.

In this alternative wildlife habitat would have the most long term positive benefits from the vegetation and fuel load reduction treatments proposed.

The greatest benefits for wildlife habitat from watershed actions occur in Alternative 3.

Long-term negative impacts to wildlife could result on PacifiCorp lands if it was sold and subdivided (in river Segments 2 and 3) when compared to the other alternatives. Entering into a long-term cooperative management agreement between BLM and PacifiCorp to provide consistent vegetation and wildlife management in the river canyon would provide long-term positive benefits to riparian and terrestrial wildlife species.

Alternative 4

Recreation Facilities and Management - *Campsites w/in riparian reserves (include day use areas, toilets):* Since Alternative 4 would maximize development, which is often proposed in or near the riparian areas, it would also have the greatest negative affect on wildlife dependant on these habitats. There are more proposed recreation facilities in riparian zones with deep soils in this alternative making this the most impacting alternative to pond turtle habitat. The development of the new Beswick campground in segment 3 would disrupt wildlife movements and eliminate some habitat when compared to Alternative 1 or 3. Locating the campground near Shovel Creek would have further impacts to riparian habitat important for wildlife (see Map 28).

Trails (Include fishing access pts, rapids scouting, and to interpretive sites): With the emphasis on human use, trails proposed in Alternative 4 would have the greatest potential for negative impacts on wildlife due to the number of trails. The construction of nonmotorized trails in this alternative has moderate negative impacts to wildlife, especially in riparian areas. The most negative impacts to wildlife dependent on riparian habitat occur in this alternative.

Boating facilities: A new boating take-out site would be developed at Fish Access #6, and limited improvements to some recreation facilities may occur. The take-out site at Stateline would be removed. These facilities are having continued minor impacts to the aquatic system by disrupting the natural connectivity within the riparian reserves and limiting development of riparian vegetation. Maintaining existing facilities within the riparian reserves limits the diversity of the vegetative community at the sites. Recreation development in riparian reserves limits available habitat for aquatic and riparian dependant species.

Upland recreation sites and interpretive sites: Uses of uplands for recreational purposes, such as dispersed camping, and OHV use would expand

Development of an interpretive site at J.C. Boyle powerhouse is proposed within an already massively altered site. This area is an important denning area for herptiles. Development at this site could increase wildlife and human encounters. Installation of an interpretive site and making parking available to the public is not anticipated to have additional impacts to terrestrial habitat. Landscaping this area for the interpretive site could have beneficial impacts by providing additional vegetation for landbirds. Interpretive sites on Topsy grade if appropriately sited (i.e., outside of drainage bottoms) would not be anticipated to affect the aquatic habitats within the canyon.

Whitewater and motorized boating: The amount of boating activity that could occur under Alternative 4 could affect wildlife through continued disturbances. As more boats travel along the river, the disturbances become more frequent. As these disturbances start to occur

more frequently, the periods available for foraging or sunning become smaller and the cumulative effects could start to affect the health of certain animals do to lack of foraging time or opportunity to sun.

Firearm use restrictions: Restrictions placed on firearm use and hunting activities around campgrounds, trails, or other concentrated human use areas, could reduce the effectiveness of population control through hunting. This is not expected to be a problem under Alternatives 1,2, or 3.

Road Management - *Road treatments (decommissioning/closures, improvements):* Human use is emphasized in Alternative 4 and therefore, the amount of open roads would be greatest. This alternative opens the PacifiCorp lands in California to designated OHV tour routes. These lands were closed to the public in Alternative 1. Negative impacts to wildlife would be moderate from noise and vehicle traffic. The greatest negative impact from motorized trails occurs in Alternative 4 (see Map 16 and 20a).

Bridge upgrades (Rock Creek and/or upper Frain): Construction of a bridge would facilitate traffic to move more freely and encourage more use of the area. This would create more potential for disturbance to wildlife. Bridges can provide additional nest structures for birds such as swallows or robins and can also provide good daytime or nocturnal roosts for bats. The rocks around the base of the abutments can also provide important habitats for aquatic mammals. This habitat is not in short supply but the rock riprap would make wildlife viewing very accessible.

Cultural Resource Management - *Historic site preservation:* Maintenance of old structures would continue to provide the man-made habitats that certain species of wildlife have adapted to using. Restoration or renovation could enhance these opportunities as long as the restoration occurs with natural products. Installing metal roofs or plastic siding would have a negative effect on the use of these structures as habitat (see Map 4 and Appendix H).

Vegetation Management - The establishment of more developed recreation sites in this alternative would alter some vegetative treatment areas. This alternative has the second highest amount of treatment proposed. Most treatments would be in upland or modified if in the riparian zones (see Map 24).

Terrestrial Species/Habitat Management - Fuel reduction activities around large trees and in riparian zones would benefit eagle and osprey nest sites by reducing potential for devastating fire. These fuel reduction projects would also benefit pond turtles and other species that need more open riparian habitat.

Existing and man-made nest structures would provide additional perch and nest sites for ducks, raptors, robins, swallows, etc. These types of structures would be maximized under this alternative near recreation developments to provide more wildlife viewing opportunities. These structures would benefit those species that can become acclimated to recreational activity.

Management of the vegetative communities would be reduced from the amount proposed in Alternative 3. They would still be scattered throughout the area. Wildlife effects would still be positive from improved mast crops, diverse brush fields, and improved riparian habitat. Due to the constraints from proximity to recreation sites, the restoration of vegetative communities would be slower than in Alternative 3 but still better than Alternatives 1 and 2.

This alternative enhances terrestrial and riparian wildlife habitat by implementing more vegetation treatments and fuel load reduction projects when compared to Alternatives 1 and 2. This alternative provides for maintaining the diversity in vegetation needed to sustain diverse wildlife species, however, the greatest benefits to wildlife habitat from vegetation treatments occur in Alternative 3.

Watershed Management Actions - *Riparian restoration:* Revegetation of the decommissioned roads in riparian zones would be beneficial to wildlife and habitat. The removal of the road adds more habitat area and the revegetation speeds the recovery process. These actions are proposed under all alternatives, however, they occur less frequently under Alternative 4.

Meadow restoration: (See discussion under Alternative 2.)

Watershed improvements projects proposed in this alternative would have a greater positive benefit to wildlife habitat than alternatives 1 and but less than 2 or 3. The greatest benefits for wildlife habitat from watershed actions occur in alternative 3.

Aquatic Species/Habitat Management - *Alteration of instream flows (including temperature):* Flow rates and timing of flows would respond to needs of recreation in Alternative 4. This alternative is close to the current situation. These flows would have little effect on species that are compatible with these flows such as small shorebirds. However, this would result in continued impacts to the aquatic ecosystem from existing operations. Eagle foraging areas, pond turtle sunning opportunities would continue to be negatively affected.

Instream structures (wood/rock, side channel/chute cutoff treatments, bridge sites, and width treatments): Under Alternative 4 the channel work would be in response to river recreation opportunities such as white water rafting. There would be short-term impacts while the construction work is being completed. However, most of this type of work would be done in late summer during low flows. That time period coincides with the period of time for least wildlife conflicts.

Range Management - Under Alternatives 1, 2, and 4 the area in segment 2 would be managed as part of the Ward pasture. Under current agreements this pasture would be managed to protect or enhance big game winter range. As such it would receive limited use in early spring and occasionally a short fall use period.

Grazing management would not change much through this alternative. If PacifiCorp lands were placed under a coordinated management agreement or federal management, the grazing management would be adjusted to benefit other resources in addition to livestock management.

Fire and Fuels Management - Fire and fuel treatments would be prioritized around recreation developments under Alternative 4. Wildlife that are tolerant of human use at developed sites and respond favorably to prescribed fire would be benefited most. Areas outside of recreation sites would only be treated through the random selection process. This would result in a slow reintroduction of fire to the ecosystem.

Land Tenure - The greatest potential for long-term negative impact to wildlife would be if the existing PacifiCorp lands were subdivided and developed. In Alternative 4, the potential would exist to enter into a long-term cooperative management agreement with PacifiCorp or acquire their lands within the project alternative boundary within river Segments 2 and 3. A long-term cooperative management agreement between BLM and PacifiCorp throughout the river canyon would provide a positive benefit for wildlife. However, if PacifiCorp's lands were sold to developers this could provide a negative impact to terrestrial and riparian wildlife species.

The acquisitions possible under Alternatives 2, 3 and 4 would have the potential to provide long-term positive impacts for habitat management for all wildlife species in the alternative project boundary areas.

Cumulative Impacts – Overall, Alternative 4 provides the greatest negative impacts to wildlife when compared to the other alternatives. Recreation facilities and increased visitor use are emphasized in this alternative increasing conflicts with wildlife.

Many new recreation facilities are proposed in this alternative, which provides high negative impacts to riparian and terrestrial associated wildlife when compared to Alternatives 1, 2 and 3. The proposed new recreation facilities would disrupt wildlife movements and eliminate some habitat along the river in Segments 2 and 3, when compared to Alternative 1. Not relocating some recreation sites (in river Segment 2) would be a negative impact riparian habitat for turtles. The most negative impacts to wildlife dependent on riparian habitat occur in Alternative 4.

New non-motorized trails would be constructed to provide additional recreation access in the project boundary area where human activity has not occurred. This would be a moderate negative impact to wildlife from increased encounters with people. The negative impacts from non-motorized trail activity in this Alternative would be greater than the motorized activities due to the longer periods of time that wildlife would be exposed to people. The greatest negative impact to riparian and terrestrial wildlife from non-motorized and motorized trail activities would occur in Alternative 4.

In this alternative wildlife habitat would have moderate positive long term positive benefits from the vegetation and fuel load reduction treatments when compared to Alternatives 1 and 2. The greatest benefits to wildlife from vegetation treatments would occur in Alternative 3.

Watershed improvements projects proposed in this alternative would have a greater positive benefit to wildlife habitat than alternatives 1 and but less than 2 or 3. The greatest benefits for wildlife habitat from watershed actions occur in Alternative 3.

Irretrievable, Irreversible, and Unavoidable Impacts

Development of recreation facilities (campgrounds and trails) in pond turtle nesting areas would be an irretrievable commitment of resources. Surfacing, development of tent pads, or installation of structures would remove areas from availability to the turtles.

Surfaced or heavily maintained trails would result in irretrievable impacts to vegetation under and along the trails, especially in riparian zones. However, these are small acreages within the planning area.

The impacts from existing and newly constructed roads would be an irretrievable loss of vegetation important for wildlife. The roaded areas change by each alternative with Alternative 3 being the least impacting and Alternative 4 having the most irretrievable impacts to vegetation used by wildlife.

Watershed Values

Mainstem Klamath River Streamflow

Assumptions

As part of the FERC relicensing process, PacifiCorp, numerous stakeholders, and BLM are developing and implementing studies that will assess flow needs required to meet river management objectives, including maintenance of flow-dependent ORVs and attainment of

ACS objectives. As results from these studies become available, they will be reviewed and incorporated into this analysis. Final results will not be available until 2003 at the earliest.

Regardless of other ongoing planning and regulatory processes (including the Klamath Basin Adjudication, the development of a long-term operations plan by the USBR, the FERC relicensing process, and the development of instream flow recommendations downstream from Iron Gate Dam), this analysis assumes that BLM adjudication claims (for Segment 2) and recommended flow regimes (for Segments 1, 2, and 3) will be implemented. As discussed in Chapter 4, flow recommendations would potentially be refined on the basis of relicensing studies or other analyses, or as new information regarding fisheries and riparian management becomes available.

For the river within the planning area, numerical analyses of issues related to instream flow needs and hypothetical hydrographs are limited at present, especially for Segment 1. In this discussion, a conceptual description of possible flow regimes will be developed in order to provide information needed to assess potential effects of recommended flow regimes on flow-dependent resources (such as fisheries, recreation, riparian vegetation, etc.)

The effects of claimed and recommended flow regimes, were they to be implemented, will be discussed in regards to five parameters that describe the flow regime (Poff et al. 1997):

- Magnitude ~ the amount of water released at a given time, including peak flows and baseflows (with regards to the operation of J.C. Boyle powerhouse, daily releases of flow from one or two turbines are often referred to as “peaking”);
- Duration ~ the length of time that flows of a given magnitude persist;
- Frequency ~ the number of times that flows of a given magnitude occurs during a particular time period;
- Timing ~ for a given time scale (e.g., daily, seasonally), a description of when flows are likely to occur; and,
- Rate of Change ~ the rate at which flows change during the transition period between different flow magnitudes (with regards to operation of the J.C. Boyle powerhouse, this is often referred to as the “ramp rate”, or the act of “ramping”).

The magnitude of peak flows and summer average daily flows varies considerably between years with above or below average precipitation. In order to more comprehensively analyze the various alternatives, potential effects to flow regimes will be discussed for “average,” “wet,” and “dry” water years. Water years 2000, 1996, and 1994, respectively, were selected as representative of annual and summer (May to October) flow regimes for these water year types. Due to reservoir regulation and time lags in movement of water through irrigated areas, these water year types do not match the classification of water year types for the USBR Klamath Project, which are based on April through September inflows into Upper Klamath Lake.

Discussions regarding operations of the J.C. Boyle facilities under each alternative are based on operational patterns that occurred during the representative water years listed above, and should not be interpreted as additional constraints on PacifiCorp operations (beyond recommendations to provide flow regimes suitable for attainment of BLM management objectives).

Impacts Common to All Alternatives

The BLM will continue to pursue its pending instream flow claims to support the fisheries, recreation, and scenic ORVs in Segment 2.

BLM’s recommendations for Klamath River instream flows will be constrained by upstream and downstream water uses. Numerous ongoing planning and regulatory processes will

continue to affect the volume, and in some cases, the timing of water flowing in the river through the planning area. The BLM will continue to participate in efforts to determine how flows required to meet BLM objectives can be balanced with flows required for other resource values including hydroelectric power generation. Seasonal streamflow patterns in the river will continue to be affected by water management in the upper Klamath Basin (as discussed in BHI, 1996).

The recharge area for the springs that provide baseflow in Segment 1 has not been clearly identified. It is possible that future pumping of groundwater on lands outside of the planning area could reduce the discharge of these springs. An ongoing USGS assessment of groundwater hydrology in the Klamath Basin, including the planning area, may provide information useful for determining the potential impact of groundwater use on the planning area.

If the instream flow claims of the Klamath Tribes are decreed in the Klamath Basin Adjudication, the minimum, or baseflows, throughout the planning area would be 700 cfs throughout the year.

Because of the size of the Klamath River watershed, it is assumed that management actions proposed in various alternatives for recreation, roads, cultural resources, vegetation and wildlife would have a negligible effect on flows in the mainstem river and thus are not discussed below.

Impacts of Specific Alternatives

(Refer to Tables 5-6, 5-7, Figure 5-1, Maps 6, 17a-20a, 21-24, and Appendix H)

Alternative 1

Flow regimes proposed in this alternative focus on securing water rights for instream flows in Segment 2. A summary of allocations of water for instream flows in Alternative 1 is depicted in Table 5-6.

Segment 1 - No alterations to flow releases from J.C. Boyle Dam would occurin this alternative.

Baseflows would remain at about 100 cfs in the upper portion of the reach and between 300 and 500 cfs in the lower portion of the reach. Due to regulation of water releases at the dam, there would be little variation in baseflows in the upper portion of Segment 1. Downstream from the springs, baseflows would be higher in winter than in summer.

Peak flows would occur when the capacity of the flume and powerhouse is exceeded during periods in winter and spring. Generally, this would occur in average and wet water years, but not in dry water years. The magnitude and duration of peak flows would be reduced as a result of operation of the J.C. Boyle facilities.

Rates of change between baseflow periods and peak flow events would continue to be drastic. Transitions from 100 to more than 8,000 cfs could occur over periods of days, and shifts of up to 3,000 cfs could occur within 30 minutes (as was recorded in January 1997).

Segments 2 and 3 - Streamflow regimes designed to maintain the recreation, scenery, and fisheries ORVs would be pursued by the BLM as stated in water right claims amended in 1999. In addition, the BLM would recommend that the timing of releases at J.C. Boyle powerhouse be adjusted to resemble the release schedule that occurred during the summer of 1994, at the time of Wild and Scenic River designation.

Table 5-6.–Summary of resulting (recommended) flow regimes.

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Segment 1				
Minimum flows	Instream flows sufficient for favorable channel conditions and fish passage are emphasized	Increased baseflows would enhance fish migration	Increased baseflows with seasonal variation, would enhance fish migration and ecological processes	Increased baseflows would enhance recreational fishing and fish migration
Ramp rate	No Changes	Reduced ramp rate during the recession of flood peaks would result	Reduced ramp rate during the onset and recession of flood peaks would result	Reduced ramp rate during the recession of flood peaks would result
Peak flows, pulse flows, and recreation releases	No Changes	No Changes	Occasional releases to produce "geomorphic flows" and "pulse flows" would result	Increased flow releases would enhance whitewater recreation
Segment 2				
Minimum flows	Instream flows sufficient for favorable channel conditions and fish passage are emphasized	Provide sufficient flows for adult and juvenile stages for trout	Increased baseflows provide for all 3 life stages of trout	Flows optimize whitewater recreation opportunities while providing flows sufficient for adult and juvenile stages of trout
Ramp rates	No Changes	Reduce ramp rate	Reduce ramp rate, if peaking occurs	Reduced ramp rate
Daily flow fluctuations	No action, except as regarding minimum flows	Modify run-of-the-river flow regime would result	Run-of-the-river flow regime would result	No action, except as regarding minimum flows and ramp rates
Recreation releases	No Changes	Scheduled powerhouse releases would resemble timing, volume and duration that occurred at the time of Wild and Scenic designation.	No releases would be made to support whitewater recreation	Scheduled powerhouse releases would enhance whitewater opportunities
Adaptive management	No flow changes anticipated unless as a result of the FERC relicensing process	Instream flows revised as necessary, through the FERC relicensing process and other studies	Instream flows revised as necessary, through the FERC relicensing process and other studies	Instream flows revised as necessary, through the FERC relicensing process and other studies
Water rights	Adjudicated water rights secured for recreation and fisheries instream flows	Adjudicated water rights secured for recreation and fisheries instream flows	Adjudicated water rights secured for recreation and fisheries instream flows	Adjudicated water rights secured for recreation and fisheries instream flows
Segment 3	Flows in this segment are essentially the same as in Segment 2.			

Water right claims (pending) are to support fisheries at 625 cfs from April 1 to June 15, and 525 cfs for other periods. Flows required to support recreation and scenic values are on the order of 1,500 cfs. When the water is available, baseflow downstream from the powerhouse would be 1,500 cfs. As discussed above, flow recommendations may change as new information becomes available.

Peak flows in Segments 2 and 3 would be much like they are at present. Flows in excess of about 3,000 cfs would occur for about two months in wet years, about a month in average years, and perhaps not at all in dry years. The duration of peak flows would continue to be artificially curtailed by operation of the J.C. Boyle Dam and other upstream dams. Increased release of water from J.C. Boyle Reservoir (to meet instream flow recommendations) would increase the amount of active storage and thus lead to dampening of flood peaks relative to current conditions, but not by any significant amount.

The abrupt onset of water spilling from the dam would result in rapid transitions from 3,000 cfs to flood peaks in excess of 11,000 cfs, with occasional shifts of up to nearly 3,000 cfs over a 30-minute period (as was recorded in January 1997).

Power generation would continue to cause short duration increases and decreases in flow releases (Figure 5-1). In fall, early winter, and late spring of average water years, flows would vary between baseflow and 3,000 cfs on an almost daily basis. When possible, given the operational constraints of the J.C. Boyle facilities, baseflows would likely be regulated at approximately 3,000 cfs during late winter and early spring to provide maximum power generation. During summer months, flows would vary between baseflow and 1,500 cfs on an almost daily basis, with flows up to 3,000 cfs occurring on some weekends.

In wet years, flows would be at or above 3,000 cfs for about two months during late winter and early spring. Flows during summer and fall either would be stable at around 1,500 cfs or would fluctuate between baseflow and 1,500 or 3,000 cfs on a daily basis.

In dry years, average daily flows would be near 1,500 cfs, with fluctuations from baseflow to 3,000 cfs through early winter. Average daily flows from late winter through summer would be less than 1,000 cfs, and as low as 500 cfs in mid-summer. Ramping from baseflow to 1,500 cfs would occur, though for shorter durations than in average or wet years.

The ramp rate during the transition from baseflow to peaking would be equal to or less than the current rate of nine inches of water depth per hour, or “stage” (PacifiCorp 2000). The length of time required to complete this transition would be reduced, since the magnitude of baseflows would increase relative to current conditions.

Cumulative Effects -The flow regime in all segments of the river would continue to be highly regulated. Baseflow in Segment 1 would continue to be depleted by diversions to the powerhouse. The magnitudes and durations of baseflows in Segments 2 and 3 would be higher and longer than at present, especially during early summer.

The release of water (from the powerhouse) to fulfill instream flow claims would affect the timing of power generation. Ramping at the powerhouse and rapid onset of water spilling from the dam would continue to cause daily flow fluctuations of much higher magnitude and at greater rates of change than occur elsewhere on the Klamath River.

Alternative 2

Flow regimes proposed in this alternative are designed to meet BLM management objectives, including maintaining and enhancing ORVs and attaining ACS objectives.

A summary of allocations of water for instream flows in Alternative 2 (including recommendations for Segment 1) is depicted in Table 5-6.

Segment 1 - Increased baseflows would be recommended in this segment in order to reduce the temperature differential at the powerhouse and to support fish passage from the powerhouse to the dam. The magnitude and timing of increased baseflows would be determined during the FERC relicensing process. Accretions from the springs at river mile 223 would continue to add between 200 and 400 cfs to flows at the downstream end of Segment 1.

Peak flows would occur when the capacity of the flume and powerhouse is exceeded during periods in winter and spring. Generally, this would occur in average and wet water years, but not in dry water years. Spill from the reservoir into Segment 1 would occur at similar frequencies and durations as at present. While instream flow releases from the powerhouse may make more storage capacity available in J.C. Boyle Reservoir during summer, such releases would likely not cause any change in operations during the periods when high flow events necessitate spilling from the dam into Segment 1.

Rates of change as flow increase from baseflow to peak flow events would not be altered from current conditions. The BLM would recommend that rates of change be more gradual as flows recede, in order to prevent fish stranding and to allow processes that shape channel and riparian features to occur.

Segments 2 and 3 - Streamflow regimes designed to maintain and enhance the recreation, scenery, and fisheries ORVs would be pursued by the BLM. The "modified run-of-the-river" flow regime recommended in this alternative would incorporate the BLM water right flow claims, but would include additional elements designed to resemble natural flow regimes (refer to Table 5-6).

The modified run-of-the-river flow regime would include the following elements (see Figure 5-1).

- Minimum flows;
- A reduced ramp rate;
- Flow releases from the Powerhouse that would fluctuate within a defined range (the "flow allowance") around the daily average flow into J.C. Boyle Reservoir (plus the accretions from the springs in Segment 1); and,
- During periods when the sum of the average daily flow plus the flow allowance is less than required for recreation uses, additional peaking releases could occur to reach the recreation flow timing, volume and duration that approximated those that existed at time of designation.

Water right claim flows are required to support fisheries at 625 cfs from April 1 to June 15 and 525 cfs for other periods. Flows required to support recreation and scenic values are on the order of 1,500 cfs. The fisheries flow would serve as the absolute minimum flow. As discussed above, flow recommendations may change as new information becomes available. Baseflow downstream from the powerhouse would be determined by subtracting the flow allowance from the average daily flow into the system (reservoir inflow plus springs). Portions of the baseflow would be supplied from Segment 1 baseflows. Flow recommendations would potentially change as new information and new methods of modeling discharge-habitat relationships are applied (such as will occur during the FERC relicensing process).

Average daily flow data from water years 1994, 1996, and 2000 suggest that daily average flows would exceed 1,500 cfs until approximately the end of June in wet years, through the end of May in average years, and perhaps not at all in dry years. Even when average daily flows recede to less than 1,500 cfs, instantaneous flows would not be less than 625 or 525 cfs (the minimum discharge depends on the time of year).

Peak flows in Segments 2 and 3 would be much like they are at present. Flows in excess of about 3,000 cfs would occur for about two months in wet years, about a month in average years, and perhaps not at all in dry years. J.C. Boyle operations could affect flows during the initial and final stages of flood peaks (when flows are less than 3,300 cfs and within the operational control of the Powerhouse), but not as much as occurs currently. Overall, the onset and recession of peak flows would be much more gradual than at present.

Power generation would continue to cause daily fluctuations in discharge from the powerhouse, though they would be less dramatic than at present. During late winter and early spring of wet and average water years, flows would likely be at or above 3,000 cfs, and power generation would be maximized. In late fall and late spring of these water year types, extensive peaking outside of the flow allowance would likely not be necessary to meet recreation flow needs. In summer, average daily flows would likely be near 1,000 cfs, and some peaking in excess of the flow allowance would be necessary to meet recreation management objectives.

For much of the length of dry water years, peaking in excess of the flow allowance would be necessary to meet recreation management objectives. In order to maintain the recreation ORV, the schedule of peaking releases would resemble that which was occurring at the time of Wild and Scenic River designation. During periods when average daily flows are very low (at the fisheries absolute minimum flow during summer, for instance), it may be difficult to attain recreation flow objectives, given the reduced flow rate.

During the FERC relicensing process, the Department of the Interior would recommend that the ramp rate during the transition from baseflow to peaking be reduced from the current rate of 9 inches of stage per hour. The length of time required to complete transitions from baseflow to peaking flows could be increased (even though the difference between daily maximum and minimum flows would be reduced).

If implemented, recommendations regarding irrigation diversions operated by PacifiCorp in the Shovel Creek drainage would add upwards of 5 cfs of baseflow (in addition to the existing baseflow from Shovel Creek) to the lower portion of Segment 3 during summer months and other times of the year.

Cumulative Effects - The flow regime in all segments of the river would be highly regulated most of the time, but in a manner that approximates natural conditions more closely than the current flow regime. Ecologically important elements of natural flow regimes would occur in Segments 2 and 3.

Though they would continue to be depleted by diversions to the powerhouse, baseflows in Segment 1 would be increased relative to current conditions.

The magnitudes and durations of baseflows in Segments 2 and 3 would be higher and longer than at present, especially during early summer. The timing of power generation would be affected by the recommended flow regime. Although the magnitude of difference between daily maximum and minimum flows and the ramp rate would be reduced, ramping at the powerhouse would continue to cause daily flow fluctuations of greater frequency, higher magnitude, and at greater rates of change than would occur on adjacent reaches of the Klamath River (the Keno reach and the river downstream from Iron Gate Dam).

Alternative 3

Flow regimes proposed in this alternative are designed to meet BLM management objectives, including enhancing flow-dependent natural resource ORVs, attaining ACS objectives, and restoring riverine landforms and ecological processes. If this alternative is implemented, additional studies will be required to design flow regimes that would meet BLM management objectives.

A summary of allocations of water for instream flows in Alternative 3 (including recommendations for Segment 1) is depicted in Table 5-6.

Segment 1 - The BLM would recommend that releases from J.C. Boyle Dam be of greater magnitude and that spills occur more frequently than at present. Increases in baseflow and occasional moderate-magnitude "pulse" releases would be recommended to improve aquatic habitat and fish passage in Segment 1. These releases would be intended to restore the annual and seasonal variability characteristic of a natural flow regime, scour riparian areas and mobilize sediment. Additional modest increases in baseflow would potentially result from recommended alterations in the operation of the fish ladder and bypass screen.

Baseflows throughout the segment would vary on an annual and seasonal basis, and would generally be highest in late winter and spring. The range of values for recommended instream flows in Segment 1 will be determined with appropriate methodologies if Alternative 3 is selected. The rate of change (ramp rate) during transition periods would be low, in order to emulate natural processes.

Peak streamflows, or geomorphic flows, of sufficient magnitude and duration to alter channel features and move coarse sediment would occur on an annual basis. These geomorphic flows would have magnitudes on the order of 2,700 to 3,300 cfs and would be released in years when forecasted spill from J.C. Boyle Dam is less than or equal to 2,700 cfs. This range is based on the lowest recorded annual flood peak, and the volume of the flood that corresponds to a 1.5 year recurrence interval, derived from the relatively unimpaired peak flow regime downstream from the powerhouse. Spills in excess of the bankfull discharge would occur in years with an above average snowpack in the Upper Klamath Lake drainage basin.

During the FERC relicensing process, the Department of the Interior would recommend that a ramp rate be set for transitions from "normal" operations to flood passage operations. This would reduce the extreme rates of change that can occur at the beginning and end, and also during, spills from J.C. Boyle Dam. Rates of change between baseflow periods and peak flow events would be designed to reflect snow melt rates and runoff timing in the Upper Klamath Lake drainage basin, as well as inflows from Spencer Creek.

Segments 2 and 3 - Streamflow regimes designed to enhance the fisheries ORV and maintain the recreation and scenic ORVs would be pursued by the BLM. The "run-of-the-river" flow regime recommended in this alternative would incorporate the BLM instream flow claims, but would include elements designed to restore natural flow regimes.

The run-of-the-river flow regime would include the following elements (see Figure 5-1):

- Minimum flows;
- If and when peaking occurs, a reduced rate; and,
- Flow releases from the powerhouse that mirror the average daily flow of water into J.C. Boyle Reservoir (plus accretions from the springs in Segment 1) and minimize flow fluctuations associated with peaking.

Water right claim flows required to support fisheries are 625 cfs from April 1 to June 15 and 525 cfs for other periods. Flows required to support recreation and scenic values are on the order of 1,500 cfs. The fisheries flow would serve as the absolute minimum flow. As discussed above, flow recommendations may change as new information becomes available. Baseflow downstream from the powerhouse would be equivalent to inflows to the system (reservoir inflow plus springs), and would not vary substantially on a daily basis. Portions of these flows would be supplied from the dam (via Segment 1 baseflows). Flow recommendations would potentially change as new information and new methods of modeling discharge-habitat relationships are applied, such as will occur during the FERC relicensing process.

Average daily flow data from water years 1994, 1996, and 2000 suggest that flows in excess of 1,500 cfs would persist until approximately the end of June in wet years and through the end of May in average years, and may not occur at all in dry years. Even when flows recede to less than 1,500 cfs, baseflows would not be less than 625 or 525 cfs (the minimum discharge depends on the time of year). In this alternative, a substantial portion of baseflow for Segments 2 and 3 would be supplied from Segment 1, rather than from the powerhouse, especially during late winter and spring when baseflow releases from the dam would be highest.

Peak flows in Segments 2 and 3 would be much like they are at present. Flows in excess of about 3000 cfs would occur for about two months in wet years, about a month in average years, and perhaps not at all in dry years. Operations of J.C. Boyle facilities would no longer substantially reduce the magnitude or duration of flood peaks, although peak flows would continue to be affected by flow regulation in the upper basin. The onset and recession of flood peaks would be much more gradual than at present.

During late winter and early spring of wet water years, releases from the powerhouse would likely be at, or above, 3,000 cfs, and power generation would be maximized. In average water years, geomorphic flow releases from the dam would reduce the volume of water available for hydroelectric generation.

As there could be some situations when peaking occurs, During the FERC process the Department of the Inteior would recommend that the ramp rate during the transition from baseflow, to peaking, be reduced from the current rate of 9 inches of stage per hour. This would help to reduce daily discharge fluctuations.

If implemented, recommendations regarding irrigation diversions operated by PacifiCorp in Shovel Creek and Negro Creek would add up to 15 cfs of baseflow to the lower portion of Segment 3 during portions of the year. Recommended operations of the diversions from the river would result in slightly higher flows during the summer months.

Cumulative Effects - River flows would continue to be regulated, but in a way that incorporates the geomorphically and ecologically important elements of natural flow regimes in all segments of the planning area.

Although flows in Segment 1 could still be depleted by diversions at J.C. Boyle Dam, baseflows would be enhanced and channel-forming peak flows would be more frequent and of longer duration.

The magnitudes of baseflows in Segments 2 and 3 would be higher than at present. Daily flows would be stable, and would mirror inflows to the reservoir and the accretions from the springs in Segment 1.

Alternative 4

Flow regimes proposed in this alternative focus on securing BLM water right claim flows in Segment 2 and recommending releases from J.C. Boyle Dam to support fisheries and recreation use.

A summary of instream flow regimes in Alternative 4 (including recommendations for Segment 1) is depicted in Table 5-6.

Segment 1 - The BLM would recommend that baseflows be increased in this reach. The final baseflow recommendation will be based on both recreation and fisheries objectives. Flow studies proposed for the FERC relicensing process would determine appropriate minimum flows needed for recreational kayaking or rafting of this river reach. Scheduled recreation releases would enhance overall whitewater opportunities on the river. Any increase above the

minimum 100 cfs would improve fisheries and recreational fishing. Baseflows would persist for large portions of any given year. Due to regulation at the dam, there would be little seasonal variation in baseflows in the upper portion of Segment 1. Downstream from the springs, baseflows would be higher in winter than in summer.

Peak flows would occur when the capacity of the flume and powerhouse is exceeded during periods in winter and spring. Generally, this would occur in average and wet water years, but not in dry water years. Spill from the reservoir into Segment 1 would occur at similar frequencies and durations as at present. While instream flow releases from the dam may make more storage capacity available in J.C. Boyle Reservoir during summer, such releases would likely not cause any change in operations during the periods when high flow events necessitate spilling from the dam into Segment 1.

Rates of change as flow increase from baseflow to peak flow events (spill) would not be altered from current conditions. The BLM would recommend that rates of change be more gradual as flows recede from peak flows to baseflow, in order to prevent fish stranding and to allow processes that shape channel and riparian features to occur.

Segments 2 and 3 - Streamflow regimes designed to enhance the recreation and scenic ORVs and maintain the fisheries ORV would be pursued by the BLM as stated in water right claims amended in 1999. In addition, the BLM would recommend that the timing and magnit ude of releases at J.C. Boyle Powerhouse be adjusted to enhance recreational boating opportunities. As discussed above, flow recommendations may change as new information becomes available.

Baseflows in the river downstream from the powerhouse would increase from 300 cfs to, at a minimum, 625 cfs from April 1 to June 15, and 525 cfs for other periods. Were recreation flows to be released according to the existing claim, baseflow would be 1,500 cfs from Memorial Day to Labor Day.

Peak flows in Segments 2 and 3 would be much like they are at present. Flows in excess of about 3000 cfs would occur for about two months in wet years, about a month in average years, and perhaps not at all in dry years. The duration of peak flows would continue to be artificially curtailed by operation of the J.C. Boyle Dam and other upstream dams. Increased release of water from J.C. Boyle Reservoir (to meet instream flow requirements) would increase the amount of active storage and thus lead to dampening of flood peaks relative to current conditions, but not by any significant amount.

The abrupt onset of water spilling from the dam would be reflected in rapid transitions from 3,000 cfs to flood peaks in excess of 11,000 cfs, with occasional shifts of up to nearly 3,000 cfs over a 30 minute period (as was recorded in January 1997).

Power generation would continue to cause daily streamflow fluctuations (see Figure 5-1). In fall, early winter, and late spring of average water years, flows would vary between baseflow and 3,000 cfs on an almost daily basis. During late winter and early spring, baseflows would be regulated at approximately 3,000 cfs to provide maximum power generation. During summer months, flows would vary between baseflow and 1,500 cfs on an almost daily basis, with flows up to 3,000 cfs occurring on some weekends.

In wet years, flows would be at or above 3,000 cfs for about two months during late winter and early spring. Flows during summer and fall either would be at or above 1,500 cfs (through about the end of June) or would fluctuate between baseflow and 1,500 or 3,000 cfs on a daily basis.

In dry years, average daily flows would be near 1,500 cfs, with fluctuations from baseflow to 3,000 cfs through early winter. Average daily flows from late winter through summer would be less than 1,000 cfs, and as low as 500 cfs in mid-summer. Ramping from baseflow to 1,500

cfs would occur, though for shorter durations than in average or wet years. The timing and duration of flow releases from the powerhouse would optimize whitewater rafting opportunities by reaching flow levels of 1,500 cfs by 9:00 AM. These flows would persist for about four hours, and would be scheduled to run from Memorial Day weekend to Labor Day weekend.

During the FERC relicensing process, the Department of the Interior would recommend that the ramp rate during the transition from baseflow to peaking be reduced from the current rate of nine inches per hour. When peaking occurred, the length of time required to complete transitions from baseflow to peaking flows would be increased (even though the difference between daily maximum and minimum flows would be reduced).

Cumulative Effects - The flow regime in all segments of the river would continue to be highly regulated, but would provide a greater range of recreational opportunities.

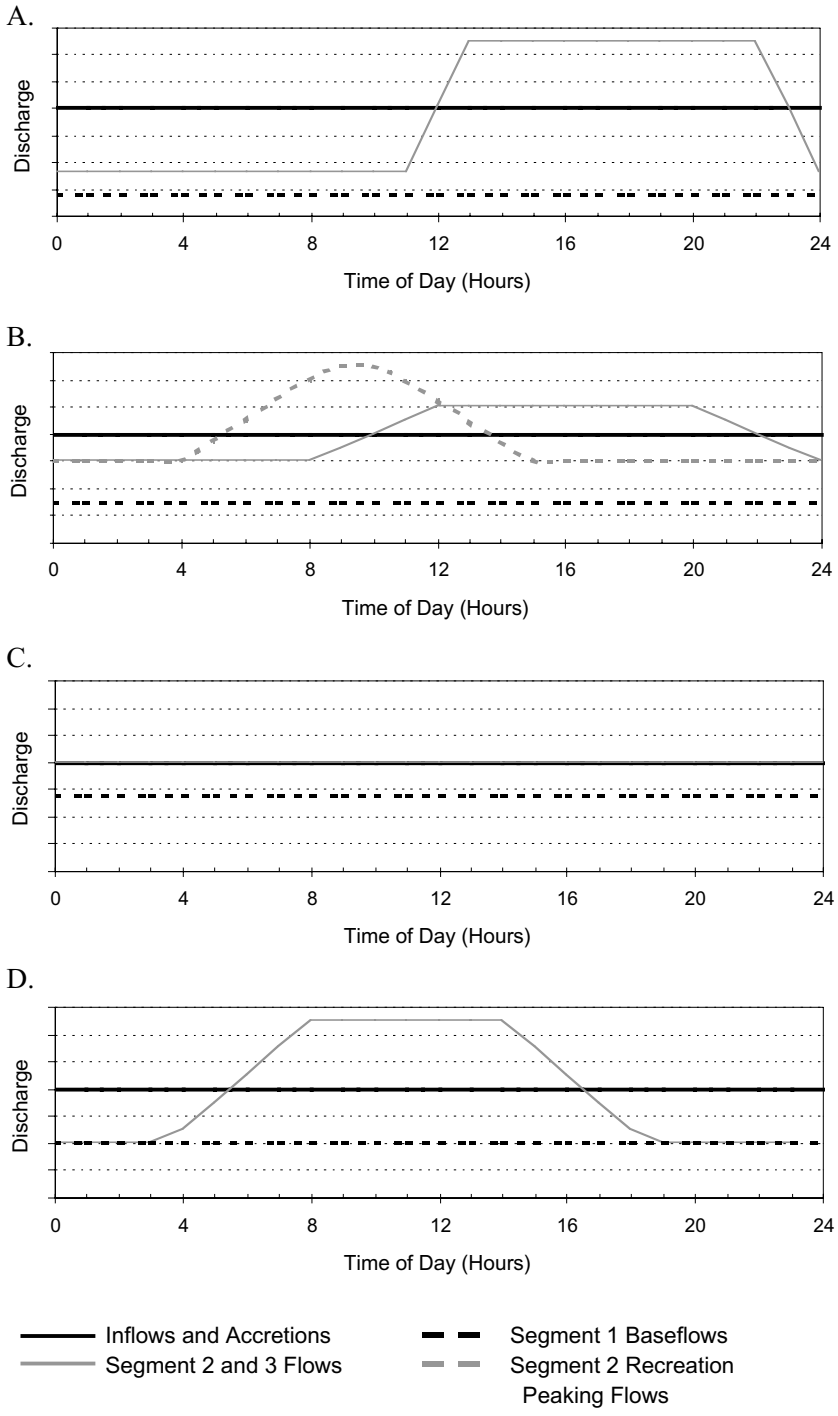
Baseflow in Segment 1 would continue to be depleted by diversions to the powerhouse. Recommended baseflow releases at the dam would benefit recreation users and the fishery.

The magnitudes and durations of baseflows in Segments 2 and 3 would be higher and longer than at present, especially during early summer. The release of water to fulfill instream flow claims would affect the timing of power generation. Although the magnitude of difference between daily maximum and minimum flows and the ramp rate would be reduced, ramping at the powerhouse would continue to cause daily flow fluctuations of greater frequency, higher magnitude, and at greater rates of change than would occur elsewhere on the Klamath River.

Table 5-7.–Hydrologic units within the planning area

Analysis Catchment		Subwatershed (6th-field hydrologic unit)		Watershed (5th-field hydrologic unit)	
Name	**Area (Sq. mi)**	**Name**	**Percent of Subwatershed within Planning Area**	**Name**	**Percent of Watershed within Planning Area**
Segment 1	2.3	Topsy Frontal	*(Watershed Boundary Lines are being Finalized)*	Middle Upper Klamath River	15%
Upper Segment 2 (NW)	3.0	Stateline Frontal			
Upper Segment 2 (SE)	3.0				
Way Creek	3.1				
Lower Segment 2	5.7				
Upper Segment 3	3.9				
Hessig Creek	2.4				
Hayden Creek	1.3	Hayden Creek	2%		
Shovel Creek	3.6	Shovel Creek	7%	Klamath River - Copco	5%
Lower Segment 3	2.6	Deer Creek Frontal	6%		

Figure 5-1.– Conceptual daily hydrographs - Conceptual daily hydrographs for Segments 2 and 3 associated with Alternatives 1 through 4 (A through D, respectively). These hydrographs were developed to be representative of summer average daily flows.



Tributary Streamflows

Assumptions

Potential cumulative effects to streamflow resulting from management actions were analyzed by dividing the planning area into 10 "analytical catchments." About a third of the planning area is within the watersheds of prominent tributary streams, such as Hayden Creek or Shovel Creek, and catchments for these streams represent the portion of the stream's watershed that is within the planning area. The remainder of the planning area was divided into catchments based roughly on river segment boundaries.

Most streams that are tributary to the Klamath River within the planning area do not originate within the planning area boundaries, and in many cases only a small portion of a tributary's drainage area is within the planning area (Table 5-7). Thus, tributary streamflows are affected more by upper watershed processes than by activities within the planning area. It is assumed for this analysis that land use in the upper portion of tributary watersheds will not change significantly over the life of this plan, and that upper watershed contributions to tributaries within the planning area also will not change substantially.

Because roads are more likely to hydrologically impact streams when they are close to the watercourses, road treatments in the riparian areas of tributary streams will potentially have a much greater relative effect on flow in these streams than will road treatments throughout the planning area as a whole.

The relative effects of management actions on streamflow would likely be higher in small drainages than in large drainages. In small drainage areas, there is a greater chance that a single treatment or series of treatments would extend over a substantial portion of the drainage area. Additionally, summer thunderstorms can have highly localized precipitation patterns that can affect a substantial portion of small drainage areas, and the extent of floodplain areas and wetlands that can buffer runoff events generally is less in small basins than in large basins (Naiman et al. 1992).

It is assumed that proposed management actions regarding recreation, cultural, and wildlife resources, as well as land tenure, would not affect runoff generation and tributary streamflow. The effects of altered flow regimes (such as higher baseflows or increased peak flows) on riparian vegetation, water quality, and fish habitat are discussed in the respective sections of this document.

Impacts Common to All Alternatives

Scenery Management - In order to improve scenery, small areas may be prioritized for vegetation management actions other than those discussed in the Vegetation Management section. These treatments would be limited in scope and extent, and would not be expected to affect streamflow. Areas affected by these treatments would contribute negligibly to cumulative effects.

Road Management - There would be no substantial change in road densities in several minor catchments. Road runoff into streams in these catchments would be reduced through spot or contiguous road improvements, and in Alternatives 2 and 3, more extensive seasonal or administrative use closures.

Road decommissioning, obliteration and improvement would lead to decreased runoff from roads during high intensity precipitation events and snow melt. Infiltration capacity would increase on obliterated roads (Luce 1997). This would decrease overland flow and theoretically increase baseflow.

Hydrologic flow paths could continue to be diverted by roads that are decommissioned, but to a lesser degree than currently occurs.

Vegetation Management - The objective of many proposed vegetation treatments is to restore conditions to within the natural range of variability. So long as these objectives are achieved and management actions do not result in severe or irreversible impacts to soils, long-term changes in flow regimes in small streams as a result of these actions would be within the range of natural channel-forming flows that have occurred in the past.

Following removal of vegetation, baseflow could increase in the short-term due to decreased transpiration demand. In stands that are thinned, increased use of water by remaining trees may negate the expected increase in water available for streamflow (Chamberlain et al. 1991). In areas where only one treatment is proposed, or where treatments will be infrequent (i.e., decades will pass between treatments) the effect on baseflow will eventually diminish (Jones 2000). In areas where community types will be altered and then maintained through fire or successive treatments (such as in oak woodlands, mixed conifer forests, and dry meadows), increases in baseflow may persist for longer periods.

Discharge from springs could increase temporarily following removal of upslope vegetation (McCarthy and Dobrowlowski 1999). This response would occur only in those springs that have fairly shallow recharge zones, as springs with deeper recharge zones would be less likely to be affected by actions within the planning area. The potential for increased water yield would be reduced by increased use of water by remaining vegetation, or re-invigorated understory communities (Chamberlain, et al. 1991; Eddleman and Miller 1991).

Most peak streamflow events in tributaries within the planning area occur as a result of snow melt, and the highest likelihood of elevated streamflows in response to proposed actions would be in areas that have southerly aspects, shallow soils, and extensive (generally, greater than on tree height) canopy openings created by proposed actions. Were they to occur, elevated peak flow magnitudes would persist until canopy closure recovers, which could take one or more decades (Harr 1976; Jones and Grant 1996).

Although slope and soil conditions favorable to runoff generation are common in the planning area, only those treatments occurring within oak and mixed conifer communities would be likely to create new openings large enough to affect snow melt. Most mixed conifer communities occur on north aspects, so treatments in these areas would have less potential to cause changes to snow melt processes.

Short-term increases in peak flows could occur as a result of the impacts of vegetation removal, prescribed fire, and mechanical equipment on soil properties. Following removal of vegetation that intercepts rainfall, the impact of raindrops can dislodge fine soil particles, which then fill pores and reduce soil infiltration rates (Dunne and Leopold 1978). Development of water repellant (hydrophobic) soil conditions that can cause overland flow generation would be most likely following intense wildfire in mixed brush and dry meadow communities. However, this effect can also occur from use of prescribed fire if fuels are very heavy and excessively high soil temperatures result. Infiltration capacity in soils in oak communities can also be reduced following fire (Hester et al. 1997; Gottfried and DeBano 1988; McNabb et al. 1989).

Prescribed fire treatments would be designed to favor low to moderate intensity burn conditions. This could cause small (likely immeasurable) increases in the magnitude of peak flows. Recovery of peak flow regimes would likely occur within five years following low intensity prescribed fire and within 10 years following moderate intensity fire (DeBano et al. 1996), depending on pre-existing soil conditions and fuel loading.

Depending on the alternative, the risk of catastrophic wildland fire would be reduced by varying degrees as a result of proposed vegetation management actions. Were a large, high

intensity fire to occur, significant peak flow responses would likely persist for longer than the effects of low intensity natural or prescribed fires (DeBano et al. 1996).

Soil disturbance could result from using mechanical equipment during project implementation. Detrimental impacts that could affect streamflow (such as compaction and development of ruts) will be minimized by restricting the use of equipment to slopes less than 35%, limiting the use of such equipment in areas with fragile soils (i.e., soils that do not have large amounts of coarse fragments and are thus more prone to compaction), and limiting operations within riparian reserves. If mechanical equipment is used while soil moisture is too high, excessive compaction could occur and cause increased runoff. Recovery from soils impacted during project implementation could slowly occur as a result of freeze-thaw processes and the growth of plant root systems. If effects are severe enough, mechanical scarification may be necessary.

Impacts of Specific Alternatives

(Refer to Maps 6, 17a thru 20a, 21 thru 24, and Appendix H)

Alternative 1

Road Management - Although this alternative has the lowest level of road decommissioning and obliteration, three of the analytical catchments that drain into Segments 2 and 3 would have substantially reduced road densities. Proposed road decommissioning and obliteration would likely reduce peak flows in the small streams within these catchments. The road within the riparian reserve of Chert Creek would be obliterated, eliminating the delivery of intercepted subsurface hillslope flow to the stream (see Map 17a).

Peak flows would also be reduced as a result of road improvements that disconnect road drainage features from stream crossings or that reduce the length of road surface or ditch flow paths (by installing cross drain culverts, for example). Road improvements near watercourses are limited in Alternative 1. Portions of Topsy Road and three other road segments (including roads in the Hayden Creek and Shovel Creek analysis catchments) would be improved, and the administrative use closures on roads in Segment 3 would continue. These actions will reduce peak streamflows by reducing runoff generation associated with deteriorated road conditions (such as ruts) and altered hydrologic flow paths.

The portion of the Chert Creek road that will be relocated out of the riparian reserve would likely be rebuilt in a mid-slope position. This new road segment could potentially intercept and divert subsurface flow paths, and could redirect surface runoff. Detrimental impacts to aquatic resources will be limited by implementing appropriate BMPs (such as installing closely spaced drainage features, or, if possible, outsloping the road surface).

The limited extent of road treatments in this alternative will produce fewer beneficial results than the more extensive actions proposed in Alternatives 2, 3, and 4.

Vegetation Management - Proposed actions may have a slight effect on the amount of water available for runoff in the small streams that drain into the river in this segment (see Map 21).

Discharge from a few springs in Segment 2 could potentially increase temporarily as a result of decreased transpiration following upslope vegetation treatments. Some small streams may experience enhanced or prolonged summer baseflow due to reduced transpiration.

The extent of vegetation treatments would likely not be sufficient to cause significant increases in peak streamflows.

Proposed vegetation management actions would reduce the risk of catastrophic wildland fire in some parts of the planning area, though less than in the other alternatives. Were a large fire

to occur, peak flows caused by high runoff from hydrophobic soils could increase in small catchments until soils and vegetation communities recover.

Fisheries - The irrigation canal that intersects Hayden Creek immediately upstream from its mouth would not be altered. Flows from Hayden Creek are diverted into the canal and do not connect with the river except during high flow events.

PacifiCorp Facilities - The diversions from Shovel Creek and Negro Creek would continue to be managed as they are at present. Summer flows downstream from the diversion points will continue to be depleted by up to about 15 cfs (or about 75 percent of summer baseflow).

Cumulative Impacts - Discharge from a few springs in Segment 2 would potentially increase as a result of decreased transpiration following upslope vegetation treatments. Baseflows could increase (likely immeasurable) in some small streams as a result of decreased road runoff and decreased transpiration. Baseflows in larger streams would likely not increase substantially, and would remain depleted in the lower portions of Hayden, Shovel, and Negro Creeks (downstream from diversions).

Peak flows could increase (likely immeasurable) in several small streams due to vegetation management treatments, but there would likely be overall decreases in some small streams due to decreased road runoff. Peak flows in large streams would likely not be affected, given the modest extent of proposed vegetation treatments.

Alternative 2

Road Management - Road decommissioning and obliteration is more extensive in this alternative than in Alternatives 1 and 4, but less than in Alternative 3 (see Map 18a).

Four of the analytical catchments that drain into Segments 2 and 3 would have substantially reduced road densities. Proposed road decommissioning and obliteration would likely cause reduced peak flows in small tributary streams within these catchments. The relative impact of reduced road densities would be more pronounced in smaller catchments that do not have large upper watersheds contributing runoff during high flow events, and the effects of proposed road obliteration or relocation in the Hayden and Shovel catchments may not be noticeable.

The road adjacent to Chert Creek would be decommissioned and re-contoured, eliminating the delivery of intercepted subsurface hillslope flow to the stream. Similar effects would occur following the removal of the road that runs parallel to the upper portion of Hayden Creek and the relocation of portions of the road adjacent to Shovel Creek.

Peak flows would also be reduced as a result of road improvements that disconnect road drainage features from stream crossings, or that reduce the length of road surface or ditch flow paths (by installing cross drain culverts, for example). Road improvements near watercourses are fairly extensive in Alternative 2, and include improving roads throughout the planning area (including roads adjacent to Rock, Hayden, and Shovel Creeks), and continuing the regulated use closures on roads in Segment 3. These actions will reduce peak streamflows by reducing runoff generation associated with deteriorated road conditions (such as ruts) and altered hydrologic flow paths.

Vegetation Management - The extent of proposed actions may be sufficient to affect streamflows in many small streams in the planning area. The magnitude of these effects would increase as a greater percentage of a given stream's drainage area is treated (see Map 22).

Discharge from numerous springs in Segments 2 and 3 would potentially increase temporarily as a result of decreased transpiration following upslope vegetation treatments. Two of these

springs flow directly into the river, while five of them flow into other fish-bearing streams (Frain, Hayden, and Shovel Creeks). The other springs do not drain directly into major streams.

Increased discharge from springs and reduced transpiration demand would make more water available for baseflow in many small streams.

Treatments in dry meadow, mixed shrub, and oak communities are extensive in Segments 2 and 3. These treatments could cause short-term increases in runoff in the Hayden Creek, Shovel Creek, and Lower Segment 2 analytical catchments. Relative impacts to peak flow would be minor in Hayden Creek and Shovel Creek, considering the large watershed areas. Proposed vegetation management actions would reduce the risk of catastrophic wildland fire in large portions of the planning area.

Fisheries – The irrigation canal that intersects Hayden Creek immediately upstream from its mouth would be retrofitted so as not to divert natural streamflows. The mouth of Hayden Creek would no longer be dewatered during low flow periods.

PacifiCorp Facilities – It would be recommended that the diversions from Shovel Creek be managed to maintain wet meadows adjacent to the river in Segment 3 while also maintaining water quality and aquatic habitat downstream from the diversion points. Less water would be diverted from the creek, and diversions would occur primarily during high flow periods. More water would remain in the creek throughout the summer and fall, increasing baseflows during the low flow period.

The diversion in Negro Creek would be recommended for removal. This would increase summer baseflows in the lower portion of Negro Creek and, subsequently, in Shovel Creek (see Map 26).

Cumulative Impacts - Discharge from numerous springs in Segments 2 and 3 would potentially increase as a result of decreased transpiration following upslope vegetation treatments. Baseflows would likely increase in some small streams as a result of decreased road runoff and decreased transpiration. Baseflows in larger streams would likely not increase substantially, except in the lower portions of Hayden, Shovel, and Negro Creeks. In Shovel Creek and Negro Creek, baseflows could increase downstream from the existing diversions (though not as much as in Alternative 3).

Peak flows may increase in several small streams due to vegetation management treatments, but would likely decrease in small streams overall, due to decreased road runoff. Peak flows in large streams would likely not be affected, due to the limited extent of proposed treatments (relative to the total watershed area).

Alternative 3

Road Management - Proposed road decommissioning and obliteration projects are more extensive in this alternative than in any other (see Map 19a).

Five of the nine analytical catchments that drain into Segments 2 and 3 would have substantially reduced road densities. Proposed road decommissioning and obliteration would likely reduce peak flows in small tributary streams within these catchments. The relative impact of reduced road densities would be more pronounced in smaller catchments that do not have large upper watersheds contributing runoff during high flow events, and the effects of proposed road management actions on peak flows in Hayden Creek may not be noticeable.

The roads that run parallel to portions of Rock, Chert, and Hayden creeks would be obliterated, and portions of the road adjacent to Shovel Creek would be relocated away from

the stream. These actions would eliminate or reduce the delivery of intercepted subsurface hillslope flow and road runoff to these streams.

Peak flows would be reduced as a result of road improvements that disconnect road drainage features from stream crossings, or that reduce the length of road surface or ditch flow paths (by installing cross drain culverts, for example). Road improvements near watercourses in Alternative 3 would be limited, though more extensive than in Alternative 1. These actions would be designed to reduce the generation of runoff on road surfaces and delivery of road runoff to watercourses, particularly along the Powerhouse road and Topsy Road, but also along Shovel Creek and the Panther Canyon road. These actions will reduce peak streamflows by reducing runoff generation associated with deteriorated road conditions (such as ruts) and altered hydrologic flow paths.

Vegetation Management - Although large portions of many analytical catchments will be affected by vegetation management actions, overall flow regimes in most large streams will not respond strongly because relatively small portions of their entire drainage basins are within the planning area. The extent of proposed actions may be sufficient to alter streamflows in many small streams in the planning area (see Map 23). Transpiration demand would be reduced across many catchments in the planning area. Baseflow in streams in Segments 2 and 3 would be enhanced or prolonged. Discharge from numerous springs in these segments would potentially increase temporarily as a result of decreased transpiration following upslope vegetation treatments. Two of these springs flow directly into the river, while five of them flow into other fish-bearing streams (Frain, Hayden, and Shovel Creeks). The remainder of the springs that could be affected, do not drain directly into major streams.

Treatments in dry meadow, mixed shrub, and oak communities are extensive in segments 2 and 3. These treatments would cause short-term increases in runoff in the Hayden Creek, Hessig Creek, Shovel Creek, and Lower Segment 2 analytical catchments. Relative impacts to peak flow would be minor in Hayden Creek and Shovel Creek. Due to the extent of proposed treatments relative to the area within its drainage basin, Hessig Creek would probably experience measurable increases in peak flows.

Fisheries - The irrigation canal that intersects Hayden Creek immediately upstream from its mouth would be retrofitted so as not to divert natural streamflows. The mouth of Hayden Creek would no longer be dewatered during low flow periods.

PacifiCorp Facilities - The irrigation diversions in Shovel Creek and Negro Creek would be recommended for removal. This would enhance summer baseflows in these streams by a total of approximately 15 cfs.

Cumulative Impacts - Discharge from numerous springs in Segments 2 and 3 would potentially increase as a result of decreased transpiration following upslope vegetation treatments. Baseflows would likely increase many small streams as a result of decreased road runoff and decreased transpiration. Baseflows in larger streams would likely not increase substantially in larger streams, except in the lower portions of Hayden, Shovel, and Negro Creeks. In Shovel Creek and Negro Creek, baseflows could increase substantially downstream from the existing diversions if recommendations regarding the PacifiCorp irrigation diversions are implemented.

Peak flows may increase (likely immeasurably) in several small streams due to vegetation management treatments, but would likely decrease in small streams overall, due to decreased road runoff. Peak flows in large streams would likely not be affected, due to the limited extent of proposed treatments (relative to the total watershed area).

Alternative 4

Road Management - Proposed road closure and decommissioning and obliteration projects are more extensive in this alternative than in Alternative 1, but much less than in Alternatives 2 and 3. Three of the nine analytical catchments that drain into Segments 2 and 3 would have substantially reduced road densities (see Map 20a).

Proposed road decommissioning and obliteration would likely reduce peak flows in small tributary streams within these catchments. The relative impact of reduced road densities would be more pronounced in smaller catchments that do not have large upper watersheds contributing runoff during high flow events, and the effects of decreased road densities on peak flows in Shovel Creek may not be noticeable. The roads that are parallel to portions of Rock Creek and Chert Creek would be obliterated, eliminating the delivery of intercepted subsurface hillslope flow and road runoff to this stream.

Peak flows would be reduced as a result of road improvements that disconnect road drainage features from stream crossings or that reduce the length of road surface or ditch flow paths (by installing cross drain culverts, for example). Road improvements near watercourses in Alternative 4 would be the most extensive of any alternative. Road improvements would be designed primarily to enhance access and visitor safety, and would not have beneficial impacts as great as in other alts. However, these projects would address documented resource damage (including flow path diversion and road-stream connectivity) and therefore would accomplish some reduction in runoff delivery to streams. This would reduce peak flows.

The portion of the Chert Creek road that would be relocated out of the riparian reserve would likely be rebuilt in a mid-slope position. This new road segment could intercept and divert subsurface flow paths, and could redirect surface runoff. Detrimental impacts to aquatic resources will be limited by implementing appropriate BMPs (such as installing closely spaced drainage features, or, if possible, outsloping the road surface).

Vegetation Management - The extent of proposed actions may be sufficient to slightly increase baseflow and peak discharge in some small streams in the planning area (see Map 24).

Transpiration demand would be reduced across many catchments in the planning area. Baseflow in streams in Segments 2 and 3 would be increased. Discharge from numerous springs in Segments 2 and 3 would potentially increase temporarily as a result of decreased transpiration following upslope vegetation treatments. Two of these springs flow directly into the river, while five of them flow into other fish-bearing streams (Frain, Hayden, and Shovel Creeks). The remainder of the springs that could be affected, do not drain directly into major streams.

Treatments in dry meadow, mixed shrub, and oak communities are extensive in Segments 2 and 3. These treatments could cause short-term increases in runoff in the Hayden Creek, Hessig Creek, Shovel Creek, and Lower Segment 2 analytical catchments. Relative impacts to peak flow would be minor in Hayden Creek and Shovel Creek given the larger drainage areas. Due to the extent of proposed treatments relative to the area within its drainage basin, Hessig Creek would probably experience measurable increases in peak flows.

Fisheries - The irrigation canal that intersects Hayden Creek immediately upstream from its mouth would be retrofitted so as not to divert natural streamflows. The mouth of Hayden Creek would no longer be dewatered during low flow periods (see Map 28).

PacifiCorp Facilities - It would be recommended that the diversions from Shovel Creek and Negro Creek be managed to maintain irrigated meadows adjacent to the river in Segment 3 while also maintaining water quality and aquatic habitat downstream from the diversion points.

Cumulative Effects - Discharge from numerous springs in Segments 2 and 3 would potentially increase as a result of decreased transpiration following upslope vegetation treatments. Baseflows would likely increase in some small streams as a result of decreased road runoff and decreased transpiration. Baseflows in larger streams would likely not increase substantially, although minor increases may occur in Hayden, Shovel, and Negro creeks It is likely that peak flows would increase slightly in several small streams, due to the combined effects of vegetation management actions and the maintenance of an extensive road network. Peak flows in large streams would likely not be affected, due to the limited extent of proposed treatments (relative to the total watershed area).

Mainstem Klamath River Water Quality

Assumptions

Proposed recreation, road, cultural resource, vegetation, and wildlife management actions would not have a significant effect on overall water quality in the river, therefore the following discussions do not cover individual resource topics like other sections of this EIS. Effects to tributary water quality (discussed later) may affect mixing zones that occur where tributaries enter the river.

The primary controlling variables on water quality in the river within the planning area are upstream conditions and streamflow. Nutrient dynamics within Upper Klamath Lake and reservoirs associated with hydroelectric generation affect numerous water quality parameters within the planning area, including nutrient loading, dissolved oxygen (DO), pH, and chlorophyll-a.

Although various data sets describe conditions within the planning area (refer to Chapter 2), there is little information regarding the relationships between streamflow and water quality dynamics that occur within J.C. Boyle Reservoir, in Segment 1, and downstream from the powerhouse. Because of this and because the streamflows that would occur in each alternative are uncertain and can only be described conceptually, the following analysis is rather general.

For the following discussion, the relationship between streamflow and water temperature was analyzed using data from the summer of 2001. Water temperature measurements at the USGS J.C. Boyle gage were collected every hour for 60 days between mid-July and mid-September (Prendergast, pers. comm., 2001).

Impacts Common to All Alternatives

The Oregon DEQ, California SWRCB, BLM, and other agencies and stakeholders have begun initial work on TMDLs that would include the planning area. The BLM is committed to the TMDL process as a means of improving water quality and will develop and implement a Water Quality Restoration Plan.

The Oregon DEQ is in the process of finalizing Total Maximum Daily Load allocations for external phosphorous loading into Agency and Upper Klamath Lakes. Reduced external phosphorous loading in Upper Klamath Lake would reduce algal biomass, resulting in improvements in water quality in Upper Klamath Lake (namely, less frequent and less severe algal die-offs, increased DO, decreased pH, and decreased chlorophyll-a abundance) (ODEQ 2001). Improvements in lake conditions would lead to similar improvements in water quality in reservoirs and river segments downstream from Link River Dam, including J.C. Boyle Reservoir and the portion of the river within the planning area. River segments upstream from the planning area would, however, continue to receive irrigation return flows which would likely have high concentrations of nutrient and high pHs, and would affect water quality in the planning area.

Stabilization of the emergency overflow spillway would occur in all alternatives (in Alternative 3, removal of the spillway could occur), and would result in decreased scour of bedrock and colluvium at its outfall. This would reduce the supply of fine sediment to the river.

No proposed action would cause continuous or long-term increases in turbidity within the river. Proposed instream restoration treatments could make fine sediment and organic matter available for transport. Appropriate BMPs would be implemented to minimize detrimental impacts associated with these projects (KFRA RMP page F-39). The volume of material available for transport, either, suspended or dissolved, would have a small and short-lived impact on turbidity.

As a component of the FERC relicensing process, numerous stakeholders are participating in the design and implementation of studies that will determine, among other things, the effect of the Klamath Hydroelectric Project on water quality. State water quality agencies will determine (through the Clean Water Act Section 401 evaluation process) whether the presence and operation of project facilities prevents attainment of water quality standards. The use of improved technologies and practices and/or mitigation may be required to minimize or eliminate adverse impacts from the project (DeVito, pers. comm.). Such actions would address water quality impairments in the planning area that are attributable to the hydroelectric project.

Impacts of Specific Alternatives

(Refer to Maps 6, 17a-20a, 21-24, and Appendix H)

Alternative 1

Streamflows - If implemented, flow regimes recommended by the BLM would result in slight reductions in the retention time of water stored in J.C. Boyle Reservoir. These reductions would be most profound in dry water years, when instream flow releases at the powerhouse would affect daily cycles of reservoir filling (refer to the discussion of Klamath River streamflow), and could potentially affect nutrient loading in downstream segments, although the effect of retention time on rates of within-reservoir nutrient cycling is uncertain (Campbell 1999).

Current baseflow releases at the dam (100 cfs minimum, per FERC license) would continue and would have low thermal mass and slow travel times (relative to other alternatives). Summer water temperatures downstream from the dam would range from about 64 to 75 degrees Fahrenheit. Warming of 1 to 2 degrees Fahrenheit occurs by the time flows have traveled a few miles downstream [get location data for temperature logger from PC]. In this alternative, the cooling effect of inflows from the springs located at RM 223would be strongest, and would reduce water temperatures to between about 55 to 62 degrees Fahrenheit by the time flows reach the downstream end of Segment 1 (Prendergast 2001; PacifiCorp 1996).

Increased baseflows downstream from the powerhouse would result in reductions in daily maximum temperatures and increased daily minimum temperatures, primarily as a result of increased thermal mass during low flow periods. Powerhouse operations would continue to accentuate the magnitude and rate of change of daily temperature fluctuations, as described in Chapter 2. Depending on the cycle of storage and release in J.C. Boyle Reservoir, reduced retention times could lead to reduced warming of stored water, and therefore reduced temperatures downstream from the powerhouse.

The water quality of flows released at the powerhouse is similar to that of flows released from the dam. During periods when baseflows of 1,500 cfs are released, water temperatures at the powerhouse would range from about 62 to 72 degrees F. Water temperatures would increase

by about 2 to 5 degrees Fahrenheit between the powerhouse and the downstream end of Segment 3. Increased flows relative to current conditions would decrease travel time and, consequently, the magnitude of warming due to exposure to ambient air temperatures and solar radiation.

In all segments, the growth rates of algae would eventually be reduced due to decreased nutrient loading in waters discharged from Upper Klamath Lake. Low flows exacerbate conditions that favor the growth of planktonic and benthic algae. Filamentous algae would continue to grow in relative abundance in Segment 1, and would not be scoured from the riverbed in this segment on an annual basis. The abundance of algae in Segments 2 and 3 could decline due to increased baseflows, which would result in increased water depth and decreased exposure to sunlight.

Levels of DO in Segment 1 would not be affected by proposed actions in this alternative. Increased baseflow downstream from the powerhouse would likely lead to increased flow velocities, increased turbulent aeration, and increased DO concentrations in Segments 2 and 3. Reduced maximum daily water temperatures would result in higher minimum DO levels.

Watershed Restoration - No instream restoration is proposed in this alternative, and channel configurations would remain unchanged or would continue to be negatively impacted by the presence and operation of the hydroelectric project. High width to depth ratios, numerous secondary channels, and thin or absent mantles of alluvial material would continue to adversely affect the rate of temperature increases as water flows through the planning area.

Cumulative Effects - Nutrient loading in the river would decrease over time due to improvements in the quality of water released from Upper Klamath Lake. Temperature regimes in Segment 1 would not change and there would continue to be a steep temperature gradient at the powerhouse.

Extreme fluctuations in temperature downstream from the powerhouse would be reduced. Increased baseflow releases from the powerhouse would increase the proportion of reservoir water to spring water, and could lead to slight increases in water temperature. Warming downstream from the powerhouse would be reduced, though not as much as in other alternatives.

Algae abundance would remain high. DO levels would increase in Segments 2 and 3.

Alternative 2

Streamflows - If implemented, flow regimes recommended by BLM would result in reductions in the retention time of water stored in J.C. Boyle Reservoir. These reductions would be most profound in dry water years, when instream flow releases at the dam and at the powerhouse would affect daily cycles of reservoir filling (refer to the discussion of Klamath River streamflow). This could potentially affect nutrient loading in downstream segments, although the effect of retention time on rates of within-reservoir nutrient cycling is uncertain (Campbell 1999).

Increased baseflows in Segment 1 would alter the balance between reservoir water and spring water in the lower portion of Segment 1. Reduced storage time in the reservoir would likely result in discharge of water that would be slightly cooler relative to current releases. More importantly, increased thermal mass would lead to decreased warming of this water as it flows downstream. The cooling effect of the springs would be reduced, thereby increasing water temperatures at the downstream end of Segment 1 and reducing the temperature gradient that occurs at the powerhouse. The magnitude of these effects would likely be less than in Alternatives 3 and 4.

Increased baseflows downstream from the powerhouse would cause increased daily minimum temperatures, primarily as a result of reductions in the relative proportions of spring inflow. Depending on the cycle of storage and release in J.C. Boyle Reservoir, reduced retention times could lead to reduced warming of stored water, and therefore reduced temperatures downstream from the powerhouse.

The magnitude of daily temperature fluctuations in Segments 2 and 3 would be reduced as a result of reduced flow fluctuations and increased baseflows. Mid-summer daily maximum temperatures would remain near 70 degrees Fahrenheit, but could be reduced slightly (as a result of decreased reservoir storage time). Daily minimum temperatures would be increased (due to the increased contribution of reservoir water). The rate of change between daily minimum and maximum temperatures would also be reduced as a consequence of the reduced ramp rate.

Water temperatures would increase by about 2 to 5 degrees Fahrenheit between the powerhouse and the downstream end of Segment 3. The rate at which water warms as it flows through these segments would be reduced due to increased thermal mass and reduced travel time.

In all segments, the growth rates of algae would eventually be reduced due to decreased nutrient loading in waters discharged from Upper Klamath Lake. Low flows exacerbate conditions that favor the growth of planktonic and benthic algae. Filamentous algae would continue to grow in relative abundance in Segment 1 (though at lower rates than in Alternative 1), and would not be scoured from the riverbed in this segment on an annual basis. The abundance of algae in Segments 2 and 3 could decline due to increased baseflows, which would result in increased water depth and decreased exposure to sunlight.

Levels of DO in Segment 1 would be affected by the release of recreation flows. Releases from the dam typically have low DO. Warmer flows in the lower portion of the reach would lead to lower DO levels, while slightly decreased algal productivity could result in higher available DO. The overall effect of proposed management actions and potential future actions upstream from the planning area is not known.

Increased baseflow downstream from the powerhouse would likely lead to increased flow velocities, increased turbulent aeration, and increased DO concentrations in Segments 2 and 3. Reduced water temperatures would also lead to increased DO levels.

Watershed Restoration - A moderate degree of instream restoration would occur in this alternative (see Map 26). Actions designed to restore channel conditions and/or reduce width-to-depth ratios are proposed for about 4.6 miles of the river. Localized treatments would restore channel features associated with bridge sites and irrigation diversions. The types of treatments proposed in secondary channels would not substantially affect water temperature.

The limited addition of gravel and CWD would create alluvial features that could beneficially affect water quality. Increased areas of gravel would lead to increased hyporheic flows, with consequent reductions in water temperature (Poole and Berman 2001). Interaction between flows, coarse sediment, and CWD would lead to pool formation and local decreases in warming rates.

An increased percentage of gravel and small cobbles within the substrate of the riverbed would lead to more frequent entrainment of particles during high flows. This disturbance mechanism would reduce the competitive advantage that some types of algae currently benefit from. This effect will be less profound in this alternative than in Alternative 3.

Beneficial effects associated with instream restoration would be greater than Alternatives 1 and 4 but less than Alternative 3. In all segments of the planning area, the reductions in width and increases in depth caused by the proposed combination of restoration actions would

reduce thermal warming and reduce rates of temperature increases. Additionally, restoration actions would cause DO to increase and algae abundance to decrease.

Cumulative Effects - Nutrient loading in the river would decrease over time due to improvements in the quality of water released from Upper Klamath Lake.

Relative to current conditions, temperatures in the upper portion of Segment 1 would be reduced, temperatures downstream from the springs would be increased, and the temperature gradient at the powerhouse would be reduced. Warming rates would decrease throughout Segment 1.

The rate and magnitude of temperature fluctuations downstream from the powerhouse would be reduced. Increased baseflow releases from the powerhouse would increase the proportion of reservoir water to spring water, and daily minimum water temperatures would increase. Warming downstream from the powerhouse would be reduced, more so than in Alternatives 1 and 4 but less than Alternative 3.

Algae abundance would be reduced all segments. Levels of DO would likely increase in Segments 2 and 3, and may also increase in Segment 1.

Alternative 3

Streamflows - If implemented, flow regimes recommended by BLM would result in reductions in the retention time of water stored in J.C. Boyle Reservoir. These reductions would likely affect reservoir operations on a daily basis during all water year types. This could potentially affect nutrient loading in downstream segments, although the effect of retention time on rates of within-reservoir nutrient cycling is uncertain (Campbell 1999).

Flow releases at the dam would introduce more reservoir water into Segment 1. Reduced storage time in the reservoir would result in discharge of water that would be slightly cooler relative to current releases. Increased thermal mass and decreased travel times (relative to current conditions) would lead to decreased warming of this water as it flows downstream. Baseflow releases would be warmer than the water that is discharged from the springs at RM 223. The higher ratio of reservoir water to spring discharge would cause temperatures downstream from the springs to increase. As a result, the steep temperature gradient at the powerhouse would be reduced.

Increased baseflows downstream from the powerhouse would cause increased daily minimum temperatures, primarily as a result of reductions in the relative proportions of spring inflow. Depending on the cycle of storage and release in J.C. Boyle Reservoir, reduced retention times could lead to reduced warming of stored water, and therefore reduced temperatures downstream from the powerhouse. The magnitude of these effects would be greatest in this alternative.

The magnitude of daily temperature fluctuations in Segments 2 and 3 would be reduced as a result of reduced flow fluctuations and increased baseflows. Mid-summer daily maximum temperatures would remain near 70 degrees Fahrenheit, but could be reduced slightly (as a result of decreased reservoir storage time). Daily minimum temperatures would be increased (due to the increased contribution of reservoir water). The rate of change between daily minimum and maximum temperatures would approximate the rate at which temperature fluctuates due to changes in ambient air temperature and solar radiation inputs.

Water temperatures would increase by about 2 to 5 degrees Fahrenheit between the powerhouse and the downstream end of Segment 3. The rate at which water warms as it flows through these segments would be reduced due to increased thermal mass and reduced travel time. In all segments, the growth rates of algae would eventually be reduced due to decreased nutrient loading in waters discharged from Upper Klamath Lake. The abundance of

filamentous algae would be reduced in Segment 1 as a result of increased water depths and annual scour by high flows. The abundance of algae in Segments 2 and 3 could decline due to increased baseflows, which would result in increased water depth and decreased exposure to sunlight. Overall, reductions in algae abundance would be highest in this alternative.

Levels of DO in Segment 1 would be affected by the release of baseflows. Warmer flows in the lower portion of the reach would lead to reduced solubility of DO. Slightly decreased algal productivity could result in higher available DO. The overall effect of proposed management actions and potential future actions upstream from the planning area is not known.

Increased baseflow downstream from the powerhouse would likely lead to increased flow velocities, increased turbulent aeration, and increased DO concentrations in Segments 2 and 3. Reduced water temperatures and would also lead to increased DO levels.

Watershed Restoration - An extensive instream restoration program is proposed in this alternative. Actions designed to restore channel conditions and/or reduce width-to-depth ratios are proposed for about nine miles of the river. Localized treatments would restore channel features associated with bridge sites and irrigation diversions (see Map 27).

Actions designed to reduce the frequency of flow through secondary channels would beneficially affect water temperature, primarily because the current configuration of these channels is such that, during low to moderate (about 300 to 1,500 cfs) flow conditions, flow through them is shallow and, in places, slow. The proposed actions would reduce warming associated with these conditions.

The restoration of coarse sediment and CWD regimes would create alluvial features that could beneficially affect water quality. Increased areas of gravel would lead to increased hyporheic flows, with consequent reductions in water temperature (Poole and Berman 2001). Interaction between flows, coarse sediment, and CWD would lead to pool formation and local decreases in warming rates. The extent of these actions is higher in this alternative than in Alternative 2, and much higher than Alternative 4.

An increased percentage of gravel and small cobbles within the substrate of the riverbed would lead to more frequent entrainment of particles during high flows. This disturbance mechanism would reduce the competitive advantage that some types of algae currently benefit from.

Beneficial effects associated with instream restoration would be greatest in this alternative. In all segments of the planning area, the reductions in width and increases in depth caused by the proposed combination of restoration actions would reduce thermal warming and reduce rates of temperature increases. Additionally, restoration actions would cause DO to increase and algae abundance to decrease.

Cumulative Effects - Nutrient loading in the river would decrease over time due to improvements in the quality of water released from Upper Klamath Lake.

Relative to current conditions, water temperatures in the upper portion of Segment 1 would be reduced, temperatures downstream from the springs would be increased, and the temperature gradient at the powerhouse would be reduced. Warming rates would be decreased throughout Segment 1.

The rate and magnitude of temperature fluctuations downstream from the powerhouse would be greatly reduced, and fluctuations due to powerhouse operations would be eliminated. Increased releases from the powerhouse would lead to increased daily minimum water temperatures. Reductions in warming downstream from the powerhouse would be greatest in this alternative.

Algae abundance would be reduced and DO levels would increase in all segments. These effects would be greatest in this alternative.

Alternative 4

Streamflows - If implemented, flow regimes recommended by BLM would result in slight reductions in the retention time of water stored in J.C. Boyle Reservoir. These reductions would be most profound in dry water years, when instream flow releases at the dam (on weekends) and at the powerhouse would affect daily cycles of reservoir filling (refer to the discussion of Klamath River streamflow). This could potentially affect nutrient loading in downstream segments, although the effect of retention time on rates of within-reservoir nutrient cycling is uncertain (Campbell 1999).

Recreation and fishery baseflow releases at the dam would introduce more reservoir water into Segment 1. Slightly reduced storage time in the reservoir would result in discharge of water that would be slightly cooler relative to current releases. Increased thermal mass would lead to decreased warming of this water as it flows downstream.

Baseflow and recreation releases would be warmer than the water that is discharged from the large springs at RM 223. The higher ratio of reservoir water to spring discharge would reduce the cooling effect that spring inflows have in Segment 1. As a result, the steep temperature gradient at the powerhouse would be reduced, though likely not as much as in Alternative 3.

Increased baseflows downstream from the powerhouse would result in slightly increased daily minimum temperatures, primarily as a result of reductions in the relative proportions of spring inflow. Depending on the cycle of storage and release in J.C. Boyle Reservoir, reduced retention times could lead to reduced warming of stored water, and therefore reduced temperatures downstream from the powerhouse. The magnitude of these effects would be about the same as in Alternative 1, and less than in Alternatives 2 and 3.

The magnitude of daily temperature fluctuations in Segments 2 and 3 would be reduced but not as much as in Alternatives 2 and 3. Mid-summer daily maximum temperatures would remain near 70 degrees Fahrenheit, but could be reduced slightly (as a result of decreased reservoir storage time). The rate of change between daily minimum and maximum temperatures would continue to be affected by ramping at the powerhouse, but would be reduced relative to current conditions.

Water temperatures would increase by about 2 to 5 degrees Fahrenheit between the powerhouse and the downstream end of Segment 3. The rate at which water warms as it flows through these segments would be reduced due to increased thermal mass and reduced travel time, but not as much as in Alternatives 2 and 3.

In all segments, the growth rates of algae would eventually be reduced due to decreased nutrient loading in waters discharged from Upper Klamath Lake. Low flows exacerbate conditions that favor the growth of planktonic and benthic algae. Filamentous algae would continue to grow in relative abundance in Segment 1 (though at lower rates than in Alternative 1), and would not be scoured from the riverbed in this segment on an annual basis. The abundance of algae in Segments 2 and 3 could decline due to increased baseflows, which would result in increased water depth and decreased exposure to sunlight.

Levels of DO in Segment 1 would be affected by the release of baseflows. Warmer flows in the lower portion of the reach would lead to reduced solubility of DO. Slightly decreased algal productivity could result in higher available DO. The overall effect of proposed management actions and potential future actions upstream from the planning area is not known.

Increased baseflow downstream from the powerhouse would likely lead to increased flow velocities, increased turbulent aeration, and increased DO concentrations in Segments 2 and 3. Reduced water temperatures would also lead to increased DO levels.

Watershed Restoration - A limited degree of instream restoration would occur in this alternative. Actions designed to restore channel conditions and/or reduce width-to-depth ratios are proposed for about 1.6 miles of the river. Localized treatments would restore channel features associated with bridge sites and irrigation diversions. The types of treatments proposed in secondary channels would not substantially affect water temperature (see Map 28).

Localized addition of gravel and CWD would create small extents of alluvial features that could beneficially affect water quality. Increased areas of gravel would lead to increased hyporheic flows, with consequent reductions in water temperature (Poole and Berman 2001). Interaction between flows, coarse sediment, and CWD would lead to pool formation and local decreases in warming rates.

An increased percentage of gravel and small cobbles within the substrate of the riverbed would lead to more frequent entrainment of particles during high flows. This disturbance mechanism would reduce the competitive advantage that some types of algae currently benefit from. This effect will be less profound in this alternative than in Alternatives 2 and 3, and could be negligible if the added material disperses and is embedded within a matrix of coarser fragments.

Beneficial effects associated with instream restoration would be greater than Alternative 1 but less than Alternatives 2 and 3. Limited reductions in width and increases in depth caused by the proposed combination of restoration actions would reduce thermal warming and reduce rates of temperature increases, primarily in Segments 2 and 3. Additionally, restoration actions would cause DO to increase and algae abundance to decrease.

Cumulative Effects - Nutrient loading in the river would decrease over time due to improvements in the quality of water released from Upper Klamath Lake.

Relative to current conditions, water temperatures in the upper portion of Segment 1 would be reduced, temperatures downstream from the springs would be increased, and the temperature gradient at the powerhouse would be reduced. Warming rates would be decreased, though not as much as in Alternatives 2 and 3.

The rate and magnitude of fluctuations in temperature downstream from the powerhouse would be reduced. Increased baseflow releases would lead to slight increases in water temperature. Warming downstream from the powerhouse would be reduced, more so than in Alternative 1 but less than in Alternatives 2 and 3.

Algae abundance would be reduced in all segments, though not as much as with Alternatives 2 and 3. Levels of DO would increase in segments 2 and 3, though not as much as with Alternatives 2 and 3.

Tributary Water Quality

Assumptions

Water quality parameters discussed in this analysis include turbidity, nutrients, water temperature, and dissolved oxygen.

Impacts to water quality tend to be cumulative within a watershed. Water quality degradation occurring at a downstream point will generally add to the effects of upstream degradation. As

with streamflow, water quality in tributary streams within the planning area is affected by physiographic features and land management activities outside of the planning area.

Turbidity is a measure of the clarity of water, and is an indirect measure of suspended sediment and organic matter concentrations. Sediment is delivered to streams in the planning area from bank erosion, road runoff, and soil erosion from hillslopes. Sediment delivery from road surfaces is a function of surface type and condition, type and condition of road drainage features, and level of use (sediment production increases with increased use, especially during wet periods) (Reid and Dunne 1984). It is assumed that, for a given road, sediment production will be highest if the road is open year round, lowest if the road is open only for administrative access and relatively low if the road is seasonally closed.

Nitrogen is the primary nutrient of concern in the planning area. Nitrogen levels in surface water can increase following vegetation management actions, as breakdown of leaf litter is accelerated due to altered microclimates (sites are warmer and wetter following removal of overstory layers). Once vegetation is removed, the uptake of available nutrients is reduced and they are made available to surface water through leaching or soil erosion. Prescribed fire and wildfire can accelerate these processes through volatilization and ashfall deposition of organic material (Swanston 1991; DeBano et al. 1996).

The temperature of large streams is partly a function of the temperature and quantity of groundwater and tributary inflow, as well as factors such as air temperature, slope aspect, shading, channel geometry, and flow volume (Poole and Berman 2001, Larson and Larson 1996). Assuming no accretions of cold water, streams tend to warm as they flow, a result of heat exchange between the atmosphere and the water in the stream. Downstream shading does not substantially lower temperatures of streams warmed by upstream exposure, and water temperatures of large streams increase if small tributaries are exposed to solar radiation. Shading and hyporheic flows (subsurface flows through gravel) can reduce the rate of warming as water flows downstream (Poole and Berman 2001).

Temperature directly affects the amount of oxygen in water – the colder the water, the more oxygen it can hold. Warming of water will cause reductions in dissolved oxygen concentrations (ODEQ 2000). Too much fine organic debris in streams can also deplete oxygen levels, a result of oxygen use by microorganisms during decomposition. Dissolved oxygen levels are typically lowest in the summer, when water temperatures and microbial decomposition peak.

Bacterial contamination of surface water can occur as a result of livestock grazing or dispersed recreation use near streams. Fecal coliform does not directly affect the suitability of fish habitat, though it can promote algal growth. Contamination can be a potential health hazard in areas where water contact recreation occurs. Bacterial concentrations tend to peak during summer months when low flows combine with high recreation and grazing use.

Impacts Common to All Alternatives

Recreation Management - Development, use, and management of dispersed campsites near Topsy Creek, Frain Creek, and Shovel Creek would include falling of hazard trees and likely some firewood cutting. The overall impacts to stream shading and water temperature would be limited.

Trails built and/or maintained near streams and wetlands could provide a source of fine sediment if not properly located and maintained. Appropriate drainage features would be installed in order to address this concern.

Road Management - The density of roads that are open year-round in the Hayden Creek, Shovel Creek, and Hessig Creek catchments would be low (less than 0.1 miles per square mile in both). The year-round open road density would be less than or approximately equal to one

mile per square mile in the Way Creek, Lower Segment 2, and Upper and Lower Segment 3 catchments, and would not vary substantially by alternative. Overall, the potential for sediment delivery from roads in these catchments would be relatively low compared to other portions of the analysis area (although some specific sites near streams could deliver sediment, depending on the alternative).

The installation of enlarged culverts along Frain Creek would reduce diversion of streamflow onto road surfaces and subsequently reduce sediment delivery. Because this creek has a small drainage basin, this action (in addition to other proposed actions that vary by alternative) would have a high likelihood of substantially reducing turbidity in this stream. The road parallel to the lower portion of Frain Creek would remain open in all alternatives (although on a seasonal basis in Alternative 3).

Sediment delivery to streams following road treatments (including decommissioning, obliteration, and treatments at stream crossings) may increase as a result of disturbances to road surfaces and ditches. These increases would occur primarily during the first few runoff events following treatment. Various types of road decommissioning would have different effects on sediment delivery to streams. Road decommissioning would not be likely to result in short-term increases, but would have the lowest likelihood of reducing sediment delivery in the long-term. Obliteration could lead to delivery of sediment pulses in the short-term, but would reduce sediment delivery in the long-term

Noxious Weeds - Label stipulations regarding the use of chemical agents for weed control will be followed, thereby minimizing the risk of introducing toxic chemicals into watercourses.

Vegetation Management – Some decreases of shading along seasonally intermittent or ephemeral streams would result from proposed vegetation management actions. The lack of flow during the summer period precludes the occurrence of detrimental effects to water temperature during the time when water temperature is of greatest concern. Likewise, detrimental impacts to summer DO in intermittent or ephemeral streams would be negligible.

With regards to the effects of vegetation management actions on water quality, actions can be grouped as either wetland restoration treatments, which would generally improve water quality, or upland vegetation treatments, which would have varying effects on water quality. It is assumed that actions within riparian reserves would be more likely to affect water quality than actions that occur further from watercourses.

Range Management – Channel adjustments to livestock and wild horse utilization of riparian vegetation can affect sediment delivery and water temperature. In all alternatives, proposed use levels, coupled with proposed exclosures, would limit these effects on BLM and PacifiCorp land. Restoration of channel features affected by past use is proposed in Alternatives 2, 3, and 4.

Some bacteria could be introduced into surface water from livestock use. The limited number of cattle on BLM land, combined with the livestock exclosure along Shovel Creek, reduces the occurrence of direct introduction of bacteria. Range use on private land in the planning area may introduce some bacteria into Rock and Way Creeks.

These treatments would potentially increase short-term surface runoff and delivery of sediment and nutrients to stream channels, especially in areas where fire is used to complement mechanical treatments. The relative effect of these impacts would be minimal in all of these streams, since the total drainage basin areas are much larger than the proposed treatment units or the proposed treatment units are limited in size. Increases in sediment or nutrient concentrations would be short-lived, since most of the effects of prescribed fire on the hydrological and chemical processes that affect water quality do not persist for more than a

few years (Choromanska and DeLuca, 2001; McNabb et al., 1989; Gottfried and DeBano, 1988).

Impacts of Specific Alternatives

(Refer Maps 6, 21-24, and Appendix H)

The following discussions of impacts are not listed by individual resource topics as other sections of this EIS, but are consolidated into "Fish-Bearing Tributary Streams" and "Other Tributary Streams" (non-fish-bearing streams).

Alternative 1

Impacts to tributary stream water quality will result primarily from proposed road treatments and vegetation management actions.

Fish-Bearing Tributary Streams - Limited road treatments in Segments 2 and 3 would cause minor reductions in sediment delivery to Frain Creek, Rock Creek, Hayden Creek, Negro Creek, and Shovel Creek (see Map 17a).

Wetland restoration would occur upstream from the fish-bearing portion of Rock Creek. By restoring the infiltration capacity and vegetation communities in this meadow, and reducing vehicle traffic through the meadow, the role of the meadow as a sediment and nutrient sink (or storage area) would be restored. This would reduce the concentration of sediment and nutrients downstream. Increased groundwater recharge and eventual discharge, as baseflow would decrease downstream summer water temperatures.

Treatments likely to directly affect stream shading and water temperature are limited in Alternative 1. In the first ten-year period, about 90 acres of oak woodlands or mixed conifer woodlands would be thinned within the riparian reserves of fish-bearing streams. Limited thinning would occur adjacent to short segments of Hayden Creek, and along portions of Frain Creek and Rock Creek that are above the upper limit of fish use. Stream shading would be decreased along these streams, although physiographic characteristics (such as north aspects and/or steep canyon walls), the limited extent of treatments, project design features, and expected vegetation recovery would reduce the long-term risks of these actions to water temperature.

Increased baseflow from springs, meadows, and small tributary channels near the mouth of Hayden Creek could slightly increase summer baseflow in the lower portion of Hayden Creek. This would reduce summer water temperatures in this stream, especially since the aquifer discharge would have little opportunity for exposure to solar radiation and warming prior to entering this stream reach.

Dissolved oxygen concentrations in streams near vegetation treatment units could decrease as a result of a potential increase in water temperature or increased volumes of fine organic matter. As discussed above, expected temperature increases are minimal and would be short-lived. Project design features (such as no treatment zones and limited stream crossings) would limit the delivery of organic matter to stream channels. Reduced vegetation density in treatment units would reduce the delivery of fine organic matter via litter fall. No long-term detrimental effect on dissolved oxygen levels is expected as a result of proposed actions.

No toilets would be installed at existing recreation sites in this alternative. Nutrients and human waste could leach into surface water near recreation sites. This would potentially affect fecal coliform concentrations in Frain Creek and Rock Creek.

Other Tributary Streams - Road treatments would reduce sediment delivery into minor tributary streams. Relocation of the Chert Creek road would reduce sediment delivery to this

stream in the long-term, though runoff from the proposed replacement road would be high for the first few years. The year-round open road density would be relatively high (but lower than in Alternative 4) in the frontal catchments along the river in Segment 1 and the upper portion of Segment 2.

Stream shading would be reduced along some streams that are tributary to the river in Segment 2. Canopy closure on about 80 acres near non-fish-bearing streams would be reduced by vegetation management actions. The effects of increased exposure on summer water temperature would be minimal, since many of these streams do not flow during the months when solar radiation is highest. In addition, the effect on steep north aspects of some of these streams would be limited, and vegetation recovery would further limit water temperature responses to decreased canopy closure.

No toilets would be installed at existing recreation sites in this alternative. Nutrients and human waste could leach into some streams in Segment 2 that have nearby dispersed campsites.

Cumulative Impacts - In the long-term, proposed actions would maintain or improve water quality in tributary streams.

Sediment delivery to tributary streams would decrease, but not as much as in other alternatives. Nutrient loading in streams could increase in the short-term, but would be reduced in the long-term in some streams. Projects designed to restore conditions in vegetation communities adjacent to streams could cause short-term increases in water temperatures, but are not as extensive in this alternative as in the others. Despite the limited extent of vegetation treatments, detrimental impacts to water temperature would not be offset by other proposed actions (as in Alternatives 2 and 3). Minimal effects to dissolved oxygen and bacterial concentrations are anticipated.

In Shovel Creek and Negro Creek, summer water temperatures and DO levels would continue to be detrimentally affected by irrigation withdrawals. In Hayden Creek, DO levels may decrease in the short-term (until peak flows flush excess organic matter from the stream) but may increase slightly in the long-
term due to enhanced baseflows.

Alternative 2

Impacts to water quality would result primarily from proposed road treatments, vegetation management actions, in-stream restoration projects, and recreation developments or facility upgrades.

Fish-Bearing Tributary Streams - Road treatments in Segments 2 and 3 would reduce sediment delivery to Frain Creek, Rock Creek, Hayden Creek, Negro Creek and Shovel Creek. More extensive road decommissioning (relative to Alternatives 1 and 4) in these drainages would result in greater reductions in sediment delivery to stream channels. Large reductions in sediment delivery to Frain, Rock, and Hayden Creeks would occur when the native surface roads that cross or run parallel very closely to these streams are improved, decommissioned, or permanently closed (see Map 18a).

Wetland restoration would occur adjacent to the fish-bearing portions of Frain Creek and Hayden Creek, and upstream from the fish-bearing portion of Rock Creek.

Restoring the infiltration capacity and vegetation communities in the Rock Creek meadow, and reducing vehicle traffic through this meadow would restore the role of the meadow as a sediment and nutrient sink. This would reduce the concentration of sediment and nutrients downstream. Increased groundwater recharge and eventual discharge as baseflow would decrease downstream summer water temperatures.

Restored floodplain connectivity and function adjacent to Frain Creek and Hayden Creek would reduce the effects of peak flows on bank erosion rates and sedimentation. In addition, native vegetation communities in these meadows would capture fine sediments and enhance infiltration rates. Burning the meadows near Hayden Creek would likely reduce infiltration rates and increase runoff and sediment delivery in the short-term, until litter layers and soil properties recover. In order to minimize these effects, the burn will be done at a time that favors low intensity burn conditions, and revegetation will occur afterwards.

Treatments likely to directly affect stream shading and water temperature are more extensive in this alternative than in Alternatives 1 and 4, but are less extensive than in Alternative 3. About 470 acres of oak woodlands, mixed conifer woodlands, or riparian hardwood-mixed conifer woodlands would be thinned within the riparian reserves of fish-bearing streams (see Map 22).

Thinning would occur along short portions of fish-bearing reaches in Hayden and Rock Creek, and along more extensive segments of Negro Creek and Shovel Creek. In Frain Creek, Rock Creek, and Hayden Creek additional vegetation treatments would occur upstream from fish-bearing reaches. Stream shading would be decreased along these streams, more so than in Alternatives 1 and 4. Because the effects of proposed actions on water temperature would be greater in streams with south aspects and low topographic shading, Hayden Creek would have the greatest risk of increased summer water temperatures. Proposed treatments along Hayden Creek, as well as along Negro and Shovel Creeks, would be designed to restore the structure and function of mixed hardwood-conifer forests, including the conditions that favor establishment of streamside deciduous understory communities, while minimizing short-term adverse impacts to water quality.

The impacts of proposed vegetation management actions on water temperature in Hayden, Negro, and Shovel Creeks would be offset by other proposed actions that would enhance summer baseflow, reduce the use of diversions during low flow periods, and reduce channel width to depth ratios.

Increased baseflow from springs, meadows, and small tributary channels near the mouth of Hayden Creek could slightly increase summer baseflow in the lower portion of Hayden Creek. This would reduce summer water temperatures in this stream, especially since the aquifer discharge would have little opportunity for exposure to solar radiation and warming prior to entering this stream reach. In addition, the reconnection of Hayden Creek to its mouth would improve water quality in the stream segment downstream from the irrigation canal.

Baseflow would be higher in Negro and Shovel Creek, primarily as a result of removing or reducing the use of irrigation diversions. Summer flow downstream from these diversions would increase, thereby reducing the magnitude of temperature increases that occur downstream from the diversions.

Instream projects designed to reduce channel widths, increase pool depths, and increase storage of gravel and cobble substrate would reduce exposure to solar radiation and increase hyporheic flows, thereby reducing water temperatures.

Dissolved oxygen concentrations could decrease as a result of a potential increase in water temperature or increased volumes of fine organic matter. As discussed above, expected temperature increases would be offset or limited. Project design features (such as no treatment zones and limited stream crossings) would limit the delivery of organic matter to stream channels. Reduced vegetation density in treatment units would reduce the delivery of fine organic matter via litter fall. No effect on dissolved oxygen levels is expected as a result of proposed actions.

Toilets would be installed at existing or proposed recreation sites near fish-bearing streams in this alternative (see Map 14). Although use of these sites would likely increase, nutrients and

human waste would be contained thus eliminating a potential source of contamination of water quality.

Other Tributary Streams - Extensive road decommissioning and improvements would reduce sediment delivery into tributary streams, especially Chert Creek. Turbidity and suspended sediment concentrations would decrease, although short-term increases as a result of disturbances to road surfaces and ditches may persist for the first few runoff events following treatment. The year-round open road density would be reduced (but less than in Alternative 3) in the frontal catchments along the river in Segment 1 and the upper portion of Segment 2.

Excluding vehicle use from wet meadows would improve hydrological and ecological functions, including their role as sediment and nutrient sinks. Infiltration into these meadows during runoff periods would provide a source of baseflow during summer months.

Stream shading would be reduced along some streams that are tributary to the river, primarily in Segments 2 and 3. Canopy closure on about 240 acres near non-fish-bearing streams would be reduced by vegetation management actions. The effects of increased exposure on summer water temperature would be minimal, since many of these streams do not flow during the months when solar radiation is highest. In addition, the steep north aspects of some of these streams would further limit water temperature responses to decreased canopy closure.

Toilets would be installed at existing or proposed recreation sites near one non-fish-bearing stream in this alternative. Although use of nearby sites could increase, nutrients and human waste would be contained thus eliminating a potential source of contamination of water quality.

Cumulative Impacts - Proposed actions would improve water quality in fish-bearing streams and, in the long-term, would maintain or slightly improve water quality in other tributary streams.

Sediment delivery to tributary streams would decrease markedly. Nutrient loading in streams could increase in the short-term, but would be reduced in the long-term. Projects designed to restore conditions in vegetation communities adjacent to streams could cause short-term increases in water temperature, though the risk of such impacts occurring would be reduced by implementation of other actions. In the long-term, summer water temperatures in tributary streams would stay about the same or decrease. Dissolved oxygen concentrations would stay the same or increase in the long-term. Minimal impacts to bacterial concentrations are anticipated.

In Shovel Creek and Negro Creek, summer water temperatures would decrease and DO levels would increase due to reduced irrigation withdrawals and instream restoration projects. In Hayden Creek, enhanced baseflows and stream restoration would cause reduced water temperatures (but less so than Alternative 3). Levels of DO in this stream may decrease in the short-term but would be increased in the long-term.

Alternative 3

Impacts to water quality would result primarily from proposed road treatments, vegetation management actions, in-stream restoration projects, and recreation developments or facility upgrades.

Fish-Bearing Tributary Streams - Road treatments in Segments 2 and 3 would substantially reduce sediment delivery to Frain Creek, Rock Creek, Hayden Creek, Negro Creek and Shovel Creek (see Map 19a). More extensive road decommissioning (relative to Alternatives 1 and 4) in these drainages would result in greater reductions in sediment delivery to stream

channels. Large reductions in sediment delivery to Frain, Rock, and Hayden Creeks would occur when the native surface roads that cross or run parallel very closely to these streams are improved, decommissioned, or permanently closed. The closure of the road to the north of Frain Ranch to public use would reduce sediment delivery to the fish-bearing reach of Topsy Creek.

Wetland restoration would occur adjacent to the fish-bearing portions of Frain Creek and Hayden Creek, and upstream from the fish-bearing portion of Rock Creek. Public access to riparian areas near the mouth of Topsy Creek would be limited.

Restoring the infiltration capacity and vegetation communities in the Rock Creek meadow, and reducing vehicle traffic through this meadow would restore the role of the meadow as a sediment and nutrient sink. This would reduce the concentration of sediment and nutrients downstream. Increased groundwater recharge and eventual discharge as baseflow would decrease downstream summer water temperatures.

Restored floodplain connectivity and function adjacent to Topsy Creek, Frain Creek, and Hayden Creek would reduce the effects of peak flows on bank erosion rates and sedimentation. In addition, native vegetation communities in these meadows would capture fine sediments and enhance infiltration rates. Burning the Hayden Creek and Rock Creek meadows would likely reduce infiltration rates and increase runoff and sediment delivery in the short-term, until litter layers and soil properties recover. In order to minimize these effects, the burn will be done at a time that favors low intensity burn conditions, and revegetation will occur afterwards.

Treatments likely to directly affect stream shading and water temperature are most extensive in this alternative. About 540 acres of oak woodlands, mixed conifer woodlands, or riparian hardwood-mixed conifer woodlands would be thinned within the riparian reserves of fish-bearing streams (see Map 23).

Thinning would occur along short portions of fish-bearing reaches Rock Creek, and along more extensive segments of Hayden Creek, Negro Creek, and Shovel Creek. In Frain Creek, Rock Creek, and Hayden Creek additional vegetation treatments would occur upstream from fish-bearing reaches. Stream shading would be decreased along these streams, more so than in Alternatives 1 and 4. Because the effects of proposed actions would be greater in streams with south aspects and low topographic shading, Hayden Creek would have the greatest risk of increased summer water temperatures. Proposed treatments along Hayden Creek, as well as along Negro and Shovel Creeks, would be designed to restore the structure and function of mixed hardwood-conifer forests, including the conditions that favor establishment of streamside deciduous shrub communities, while minimizing short-term adverse impacts to water quality.

The impacts of proposed vegetation management actions on water temperature in Hayden, Negro, and Shovel Creeks would be offset by other proposed actions that would enhance summer baseflow, reduce the use of diversions during low flow periods, and reduce channel width to depth ratios. Alternative 3 would have the greatest extent of such actions.

Increased baseflow from springs, meadows, and small tributary channels near the mouth of Hayden Creek could slightly increase summer baseflow in the lower portion of Hayden Creek. This would reduce summer water temperatures in this stream, especially since the aquifer discharge would have little opportunity for exposure to solar radiation and warming prior to entering this stream reach. In addition, the reconnection of Hayden Creek to its mouth would improve water quality in the stream segment downstream from the irrigation canal.

The irrigation diversions from Negro and Shovel Creek would be recommended for removal. Summer flow downstream from these diversions would increase, thereby reducing the magnitude of temperature increases that occur downstream from the diversions.

Dissolved oxygen concentrations could decrease as a result of a potential increase in water temperature or increased volumes of fine organic matter. As discussed above, expected temperature increases would be offset or limited. Project design features (such as no treatment zones and limited stream crossings) would limit the delivery of organic matter to stream channels. Reduced vegetation density in treatment units would reduce the delivery of fine organic matter via litter fall. No effect on dissolved oxygen levels is expected as a result of proposed actions.

Use of recreation sites near Frain Creek and Topsy Creek would likely be reduced in this alterative. No toilets would be installed at existing recreation sites in this alternative, so even limited continued use of these sites could cause some leaching of human waste into these streams.

Other Tributary Streams - Extensive road treatments would reduce sediment delivery into tributary streams, especially Chert Creek. Motorized use in the planning area would probably decrease, further reducing sedimentation. Turbidity and suspended sediment concentrations would decrease, although short-term increases as result of disturbances to road surfaces and ditches may persist for the first few runoff events following treatment. This alternative would have the greatest reductions in year-round open road density in the frontal catchments along the river in Segment 1 and the upper portion of Segment 2.

Excluding vehicle use from numerous wet meadows would improve hydrological and ecological functions, including their role as sediment and nutrient sinks. Infiltration into these meadows during runoff periods would provide a source of baseflow during summer months, when infusion of cool water can most improve water quality.

Stream shading would be reduced along some streams that are tributary to the river, primarily in Segments 2 and 3. Canopy closure on about 360 acres near non-fish-bearing streams would be reduced by vegetation management actions. The effects of increased exposure on summer water temperature would be minimal, since many of these streams do not flow during the months when solar radiation is highest. In addition, the steep north aspects of some of these streams would further limit water temperature responses to decreased canopy closure.

No toilets would be installed at existing recreation sites in this alternative, so even limited continued use of sites near streams could cause some leaching of human waste into these streams.

Cumulative Impacts - Proposed actions would improve water quality in fish-bearing streams and, in the long-term, would maintain or improve water quality in other tributary streams.

Sediment delivery to tributary streams would decrease more in this alternative than in any other. Nutrient loading in streams could increase in the short-term, but would be reduced in the long-term. Projects designed to restore conditions in vegetation communities adjacent to streams could cause short-term increases in water temperature, though the risk of such impacts occurring would be reduced or offset by implementation of other actions. In the long-term, summer water temperatures in tributary streams would decrease. Dissolved oxygen concentrations would increase in the long-term. Minimal impacts to bacterial concentrations area anticipated.

Summer water temperatures and DO levels in Shovel and Negro Creeks would be beneficially affected by proposed actions. In Hayden Creek, enhanced baseflows and stream restoration would cause reduced water temperatures (more so than Alternative 2). Levels of DO in this stream may decrease in the short-term but would be increased in the long-term.

Alternative 4

Impacts to water quality would result primarily from road improvements and increased use of roads, vegetation management actions, and recreation developments or facility upgrades (see Maps 16, 20a, 24) .

Fish-Bearing Tributary Streams - Road treatments in Segments 2 and 3 would have a mixed effect on sediment delivery to fish-bearing streams. Road decommissioning and spot improvements would reduce sediment delivery to the lower portion of Frain Creek, Hayden Creek, Negro Creek and Shovel Creek, though not as much as in Alternatives 2 and 3 (see Map 20a).

Although road-stream crossings that cause sediment delivery would be improved, many of the proposed road improvements will not directly address sediment production. Increased traffic, more frequent maintenance, and installation of less permeable road surfaces could cause a net increase in sediment delivery to some fish-bearing streams (such as Topsy Creek and the headwaters of Frain Creek). Project design features would limit the delivery of sediment directly into fish-bearing streams.

Wetland restoration would occur adjacent to the fish-bearing portion of Frain Creek, and upstream from the fish-bearing portion of Rock Creek. Restored floodplain connectivity and function adjacent to Frain Creek would reduce the effects of peak flows on bank erosion rates and sedimentation. In addition, native vegetation communities in these meadows would capture fine sediments and enhance infiltration rates.

Restoring the infiltration capacity and vegetation communities in the Rock Creek meadow, and reducing vehicle traffic through this meadow would restore the role of the meadow as a sediment and nutrient sink. This would reduce the concentration of sediment and nutrients downstream. Increased groundwater recharge and eventual discharge as baseflow would decrease downstream summer water temperatures.

Treatments likely to directly affect stream shading and thus water temperature are less extensive in this alternative than in Alternatives 2 and 3. About 370 acres of oak woodlands or mixed conifer woodlands would be thinned within the riparian reserves of fish-bearing streams (see Map 24). No treatments would occur within the riparian hardwood-mixed conifer woodlands adjacent to Hayden, Negro, and Shovel Creeks. Without vegetation treatments, the composition of forested vegetation communities along Shovel and Negro Creeks could change to a denser condition that is more prone to catastrophic disturbance and consequent reductions in shade and CWD recruitment (Bragg 2000).

Thinning would occur along short portions of fish-bearing reaches in Hayden and Rock Creek. In Frain Creek, Rock Creek, and Hayden Creek additional vegetation treatments would occur upstream from fish-bearing reaches. Stream shading would be decreased along these streams, but to a lesser degree than in Alternatives 2 and 3. Because the effects of proposed actions would be greater in streams with south aspects and low topographic shading, Hayden Creek would have the greatest risk of increased summer water temperatures.

Reduced irrigation withdrawals and thus increased summer baseflows in Shovel Creek and Negro Creek would result in reduced warming rates downstream from the diversions and thus lower water temperatures.

Increased baseflow from springs, meadows, and small tributary channels near the mouth of Hayden Creek could slightly increase summer baseflow in the lower portion of Hayden Creek. This would reduce summer water temperatures in this stream, especially since the aquifer discharge would have little opportunity for exposure to solar radiation and warming prior to entering this stream reach. In addition, the reconnection of Hayden Creek to its mouth would improve water quality in the short stream segment downstream from the irrigation canal.

Dissolved oxygen concentrations could decrease as a result of a potential increase in water temperature or increased volumes of fine organic matter. As discussed above, expected temperature increases would be offset or limited. Project design features (such as no treatment zones and limited stream crossings) would limit the delivery of organic matter to stream channels. Reduced vegetation density in treatment units would reduce the delivery of fine organic matter via litter fall. In Shovel Creek and Negro Creek, reduced summer water temperatures would increase DO saturation levels. Overall, no long-term detrimental effects on dissolved oxygen levels are expected as a result of proposed actions, and DO in Shovel Creek and Negro Creek could increase.

Toilets would be installed at existing and proposed recreation sites near fish-bearing streams in this alternative. Although use of these sites would likely increase, nutrients and human waste would be contained thus eliminating a potential source of contamination of water quality.

Other Tributary Streams - Road treatments would reduce sediment delivery into minor tributary streams. Relocation of the Chert Creek road would reduce sediment delivery to this stream in the long-term, though runoff from the proposed replacement road would be high for the first few years. The year-round open road density in the frontal catchments along the river in Segment 1 and the upper portion of Segment 2 would be highest in this alternative, leading to the highest potential for sediment delivery from roads into streams.

Increased traffic, more frequent maintenance, and installation of less permeable road surfaces could cause a net increase in sediment delivery to streams that are crossed by the Powerhouse Road, Topsy Road, and other improved roads.

Excluding vehicle use from wet meadows would improve hydrological and ecological functions, including their role as sediment and nutrient sinks. Infiltration into these meadows during runoff periods would provide an enhanced source of baseflow during summer months. OHV use may impair the function of wet meadows that would not be exclosed.

Stream shading would be reduced along some streams that are tributary to the river, primarily in segments 2 and 3. Canopy closure on about 260 acres near non-fish-bearing streams would be reduced by vegetation management actions. The effects of increased exposure on summer water temperature would be minimal, since many of these streams do not flow during the months when solar radiation is highest. In addition, the steep north aspects of some of these streams would further limit water temperature responses to decreased canopy closure.

Toilets would be installed at existing and proposed recreation sites near one non-fish-bearing stream in this alternative (see Map 16). Although use of nearby sites could increase, nutrients and human waste would be contained thus eliminating a potential source of contamination of water quality.

Cumulative Impacts - Proposed actions would maintain or slightly improve water quality in fish-bearing streams and could degrade water quality in other tributary streams.

Sediment delivery to tributary streams would probably increase. Nutrient loading in streams could increase in the short-term, but would be reduced in the long-term in some streams. Projects designed to restore conditions in vegetation communities adjacent to streams could cause some increases in water temperatures. Detrimental impacts to water temperature would not be offset by other proposed actions (as in Alternatives 2 and 3). Minimal effects to dissolved oxygen are anticipated. Bacterial concentrations would be reduced.

In Shovel Creek and Negro Creek, summer water temperatures would decrease and DO levels would increase due to reduced irrigation withdrawals. Water quality in Hayden Creek would not be substantially improved or degraded by proposed actions.

Irreversible, Irretrievable, or Unavoidable Impacts

Proposed vegetation management actions in forested riparian areas and within riparian reserves would result in short-term decreases in shading of tributary streams and possible warming of water temperatures.

Aquatic Conservation Strategy Values

This section will address the type, location, and intensity of proposed management actions within riparian reserves, and will identify the cumulative effects of these actions on the functionality of the riparian reserve system within the planning area.

Riparian reserves apply only to federal land. In order to assess the relative effects of proposed actions on federal land and recommended actions on non-federal land, "riparian corridors" were delineated for non-federal lands within the planning area.

Refer to Appendix L for a more detailed description of how Riparian Reserves and ACS Objectives would be affected by proposed actions.

Assumptions

Because of the proximity of hydrologic features to one another in some areas, numerous types of riparian reserves overlap. In these situations, effects were discussed only for one type of reserve, in order to avoid "double counting" of effects. Reserve types were prioritized as follows: fish-bearing streams, non-fish-bearing streams, wetlands greater than one acre, wetlands less than one acre, and reservoirs. For example, a vegetation treatment proposed within the reserve of both a fish-bearing stream and a wetland less than one acre would be documented as an effect to the stream.

The overall extent of riparian reserves and riparian corridors in the planning area may be overestimated in this analysis. The extent and seasonality of every intermittent and ephemeral stream has not been ground-truthed. In order to maintain a "margin of safety" in this analysis, non-perennial streams were assumed to be intermittent (though some are likely ephemeral), and thus received a 140 foot buffer (equivalent to the height of one site potential tree). The reserves associated with fish-bearing streams and wetlands are mapped accurately.

The shape of riparian reserves often takes a linear form, following the transition from riverine and riparian environments to upland features. Proposed actions within reserves can be considered as points (such as campsites), lines (such as roads and trails), and polygons (such as vegetation treatment units). Linear and polygon features would have the most influence on the function of riparian reserves, since they would impact larger portions of the reserve system. Despite their relatively small areal extent, linear features would have a disproportionate impact on functions such as connectivity and CWD recruitment. Point features would not be expected to have large overall effects, but could affect local features, and in some cases could cause effects that perpetuate downstream.

Impacts Common to All Alternatives

If it is determined that proposed actions would prevent attainment of ACS objectives, management options to improve conditions would be developed. These could range from modifying proposed actions, to removing from consideration those proposed actions (or elements of proposed actions) that would prevent attainment. The appropriate management option depends on the condition and functionality of the rest of the planning area, the

beneficial uses that occur, and the extent of other actions that restore processes to within the range of natural variability (Final SEIS, vol. II, page B-83).

Impacts of Specific Alternatives

(Refer to Tables 5-8 thru 5-14, Maps 25-28, and Appendix H)

Alternative 1

Riparian Reserves: Due to the limited scope of actions designed to restore riparian processes, this alternative is likely to maintain, rather than restore, the functionality of riparian reserves and other land near riparian features.

Recreation facilities would affect about 17 acres within riparian reserves (refer to Table 5-8), and only 4.0 miles of trail (refer to Table 5-9) which is a greater impact than Alternative 3 but less than Alternatives 2 and 4. No new sites would be constructed within riparian reserves. Nine acres would continue be directly impacted by hydroelectric facilities.

This alternative has the lowest level of road decommissioning and road improvements, and the highest open road mileage, within riparian reserves (refer to Tables 5-10a, 5-10b, 5-11a, 5-11b and 5-12). Although some of the roads that cause the most impacts to riparian reserves would be decommissioned or relocated, roads would continue to deliver runoff and sediment to watercourses, and would adversely affect the function of riparian reserves.

Vegetation treatments are proposed within the riparian reserves in order to improve stand condition and promote long-term health of the plant communities (refer to Table 5-13). Actions under this alternative will do little to improve riparian conditions.

The following summarizes the effect of management activities on the ACS Objectives. Refer also to Table 5-14 for a comparison of these effects.

ACS Objective 1 - Watershed and landscape-scale features: Some enhancement of the watershed level features and vegetative community would occur under this alternative. However, the rate of recovery would be the lowest when compared to the other three alternatives.

ACS Objective 2 - Spatial and temporal connectivity: Connectivity within the planning area would be restored somewhat, but overall would not be substantially improved relative to the current degraded condition.

ACS Objective 3 - Physical integrity: Channel configurations in the river would continue to be adversely affected by the current design and operation of the J.C. Boyle facility.

ACS Objective 4 - Water quality: Assuming the Upper Klamath Lake and scheduled Upper Klamath River TMDLs/WQMPs are implemented, water quality in the planning area would eventually improve. Overall, there would be slight improvements in certain water quality parameters, although important water quality concerns (and the effects of altered water quality on beneficial uses) in the planning area would not be comprehensively addressed.

ACS Objective 5 - Sediment regime: Although ongoing effects of the J.C. Boyle facility on coarse sediment supply and transport would not be addressed, the duration of peaking flows would be reduced and existing sediment regimes would generally be maintained or slightly improved.

*ACS Objective 6 - Instream flow*s: Flow regimes proposed in this alternative, while continuing to limit channel processes, would constitute a minor improvement over existing conditions.

Daily stage and discharge fluctuations associated with powerhouse operations would be highest in this alternative.

ACS Objective 7 - Floodplain inundation and water table elevation: Overall, the processes driving floodplain inundation and water table elevation would be maintained and no improvement would occur.

ACS Objective 8 - Plant communities: Riparian areas along tributary streams and in wet meadows would be maintained or restored. Riparian areas along the river would be maintained and would continue to resemble the existing communities.

ACS Objective 9 – Habitat: The proposed road treatments and increased based flows within the no-action alternative would be expected to maintain and potentially enhance the condition of existing habitats within the planning area. This alternative would do the least to enhance the connectivity (over both space and time) and condition of habitats within the planning area.

Alternative 2

Riparian Reserves: Actions proposed in this alternative would have a relatively high likelihood of maintaining or restoring riparian reserve functionality.

Twenty-five acres within riparian reserves would be impacted by recreation facilities, including five new sites within riparian reserves and over 17 acres would be inpacted by new trails (refer to Tables 5-8 and 5-9). Nine acres would continue to be directly impacted by hydroelectric facilities.

The extent of road decommissioning and obliteration in riparian reserves would be slightly less, but open road mileage would be almost double that in Alternative 3. Less road improvements would occur than in Alternative 4, but more would occur than in Alternatives 1 and 3 (refer to Tables 5-10a, 5-10b, 5-11a, 5-11b and 5-12).

Vegetation treatments are proposed within the riparian reserves in order to improve stand condition and promote long-term health of the plant communities (refer to Table 5-13). This alternative proposes a substantial increase over Alternative 1, and is second only to Alternative 3.

The following summarizes the effect of management activities on the ACS Objectives. Refer also to Table 5-14 for a comparison of these effects.

ACS Objective 1 - Watershed and landscape-scale features: Extensive enhancement of landscape scale features would occur under this alternative. The degree of proposed landscape scale treatments would be expected to result in increased recovery over actions proposed in Alternative 1, but less than those actions proposed in Alternatives 3 and 4.

ACS Objective 2 - Spatial and temporal connectivity: The lateral connectivity within riparian areas, and of riparian areas to adjacent upland areas, would be improved by road decommissioning and by stream crossing enhancements. Connectivity within the river would be enhanced, but fluctuating flows would limit the overall restorative benefits of proposed projects, both temporally and spatially.

ACS Objective 3 - Physical integrity: The physical integrity of the aquatic system in the river, including shorelines, banks, and bottom configurations, would be restored to a moderate degree relative to the current degraded condition.

ACS Objective 4 - Water quality: This alternative proposes an approach that would address the most critical water quality concerns within the planning area, and would have a moderate likelihood of resulting in improved water quality and beneficial uses.

ACS Objective 5 - Sediment regime: Ongoing effects to the supply and transport of fine and coarse sediment would be addressed. A moderate level of restoration of sediment regimes would occur.

ACS Objective 6 - Instream flows: Proposed stream flows would more closely resemble natural flows and would constitute a substantial improvement over existing conditions. Daily flow fluctuations would be reduced and the magnitude of the diversion around Segment 1 would be reduced.

ACS Objective 7 - Floodplain inundation and water table elevation: Overall, the processes driving floodplain inundation and water table elevation would be maintained and slightly improved and the intent of this objective would be met.

ACS Objective 8 - Plant communities: Overall, a moderate degree of active and passive restoration of riparian communities would occur in this alternative.

ACS Objective 9 – Habitat: The proposed actions would maintain and enhance aquatic habitat, riparian areas, and upland habitats located throughout the watershed.

Alternative 3

Riparian Reserves: Actions proposed in this alternative would have the highest likelihood of maintaining or restoring riparian reserve functionality (ten acres of recreation facilities and almost six acres of trails). Recreation impacts to riparian processes would be much less extensive than in Alternatives 2 and 4, though some site clearing and development of impervious surfaces would occur (refer to Tables 5-8 and 5-9).

Nine acres would continue to be directly impacted by hydroelectric facilities.

This alternative has the highest level of road decommissioning and obliteration and the lowest open road mileage (about half of the other alternatives) within riparian reserves (refer to Tables 5-10a, 5-10b, 5-11a, 5-11b and 5-12). Overall, road management actions proposed in this alternative would have the highest likelihood of supporting the functionality of riparian reserves.

Potential management agreements or land tenure adjustments would benefit the function of riparian reserves along the river and many perennial and intermittent tributary streams.

Vegetation treatments proposed within the riparian reserves, in order to improve stand condition and promote long-term health of the plant communities, are slightly more than Alternative 2 but significantly greater than Alternatives 1 and 4 (refer to Table 5-13).

The following summarizes the effect of management activities on the ACS Objectives. Refer also to Table 5-14 for a comparison of these effects.

ACS Objective 1 - Watershed and landscape-scale features: Extensive enhancement of landscape level features would occur under this alternative.

ACS Objective 2 - Spatial and temporal connectivity: Connectivity within the planning area would be enhanced and substantial enhancements in connectivity within the river corridor would occur. This alternative provides the greatest potential for recovery of spatial and temporal connectivity of the planning area with upper river reaches and the Spencer Creek Key Watershed.

ACS Objective 3 - Physical integrity: an extensive program of instream restoration would beneficially affect the physical integrity of the aquatic system in the river, including shorelines, banks and bottom configurations.

ACS Objective 4 - Water quality: This alternative proposes the most comprehensive approach to address critical water quality concerns within the planning area, and thus would be the most likely to result in improved water quality and beneficial uses.

ACS Objective 5 - Sediment regime: Overall, Alternative 3 proposes the most comprehensive approach to sediment management in the planning area, and would be the most likely to restore sediment regimes to within the natural range of variability.

ACS Objective 6 - Instream flows: Proposed flow regimes would restore aquatic and riparian habitats in the planning area, and constitute a major improvement over existing conditions.

ACS Objective 7 - Floodplain inundation and water table elevation: Overall, the processes driving floodplain inundation and water table elevation would be maintained and restored, and the intent of this objective would be met.

ACS Objective 8 - Plant communities: Overall, this alternative proposes the most extensive program of active and passive restoration of riparian communities.

ACS Objective 9 – Habitat: This alternative is the most aggressive in enhancing aquatic habitat, riparian areas, and upland habitats across the planning area and would protect habitat.

Alternative 4

Riparian Reserves: Actions proposed in this alternative would have a moderate likelihood of maintaining or restoring riparian reserve functionality.

This alternative would have the highest number of recreation sites, and the greatest level of recreation use, within riparian reserves, including seven new sites (refer to Tables 5-8 and 5-9). Overall, about 25 acres within riparian reserves would be impacted by recreation developments and 18 acres affected by trails.

Nine acres would continue to be directly impacted by hydroelectric facilities.

The magnitude of reductions in road mileage within riparian reserves would be lower than Alternatives 2 and 3 but higher than Alternative 1. This alternative has the highest level of road improvements within riparian reserves (slightly more than Alternative 2). Open road mileage within riparian reserves in this alternative is about the same Alternative 1 (refer to Tables 5-10a, 5-10b, 5-11a, 5-11b and 5-12).

Vegetation treatments are proposed within the riparian reserves in order to improve stand condition and promote long-term health of the plant communities (refer to Table 5-13). These improvements would be slightly greater than Alternative 1, but significantly lower than Alternatives 2 and 3.

The following summarizes the effect of management activities on the ACS Objectives. Refer also to Table 5-14 for a comparison of these effects.

ACS Objective 1 - Watershed and landscape-scale features: A moderate level of enhancement of landscape level features would occur under this alternative.

ACS Objective 2 - Spatial and temporal connectivity: Connectivity within the planning area would be enhanced and impairment of connectivity within the river corridor would be partially addressed. Daily flow fluctuations would limit the benefits of proposed instream restoration projects.

ACS Objective 3 - Physical integrity: The physical integrity of the aquatic system in the river, including shorelines, banks and bottom configurations, would be slightly restored relative to

the current degraded condition. The integrity of tributary stream channels could be maintained, restored, or degraded. Overall, it is likely that existing conditions would be maintained, or slightly restored.

ACS Objective 4 - Water quality: Overall, there would be slight improvements in certain water quality parameters, although important water quality concerns (and the effects of altered water quality on beneficial uses) in the planning area would not be comprehensively addressed.

ACS Objective 5 - Sediment regime: Limited restoration of coarse sediment would occur in specific areas, but ongoing effects to coarse sediment supply and transport would not be fully addressed. Elements of the sediment regimes in the river would be restored.

ACS Objective 6 - Instream flows: Proposed flow regimes would continue to affect channel processes and habitat availability, but would constitute a minor improvement over existing conditions.

ACS Objective 7 - Floodplain inundation and water table elevation: Overall, the processes driving floodplain inundation and water table elevation would be maintained or, in some areas, slightly restored.

ACS Objective 8 - Plant communities: Overall, this alternative proposes a limited program of active and passive restoration in riparian communities, with most of the restoration work occurring adjacent to tributaries and in wet meadows.

ACS Objective 9 – Habitat: This alternative would maintain and enhance aquatic habitat, riparian areas, and upland habitats located throughout the planning area.

Table 5-8.–Recreation developments within riparian reserves and corridors (in acres).

	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
	Fish-Bearing Streams	All Other Riparian Features	Fish-Bearing Streams	All Other Riparian Features	Fish-Bearing Streams	All Other Riparian Features	Fish-Bearing Streams	All Other Riparian Features
Segment 1								
BLM	–	3	<1	3	–	3	–	3
PacifiCorp	–	–	<1	–	<1	–	1	–
Segment 2								
BLM	9	–	11	1	2	2	14	1
PacifiCorp	3	<1	4	<1	–	–	4	<1
Segment 3								
BLM	–	–	–	–	–	–	<1	–
PacifiCorp	1	<1	1	4	2	<1	2	4
Total	13	4	17	8	4	6	17	8

Table 5-9.–Proposed trails within riparian reserves and riparian corridors (miles).

	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
	Fish-Bearing Streams	All Other Riparian Features	Fish-Bearing Streams	All Other Riparian Features	Fish-Bearing Streams	All Other Riparian Features	Fish-Bearing Streams	All Other Riparian Features
Segment 1								
New Trail	–	0.1	5.1	0.3	–	–	5.2	0.4
Existing Roadbed	–	–	–	–	–	–	–	–
Segment 2								
New Trail	2.8	0.8	9.6	–	5.7	–	9.8	–
Existing Roadbed	1.4	–	2.8	–	3.0	–	2.6	–
Segment 3								
New Trail	0.2	0.1	1.8	0.6	–	–	2.5	0.8
Existing Roadbed	–	–	0.3	0.1	0.3	0.1	–	0.1
Total								
New Trail	3.0	1.0	16.5	0.9	5.7	–	17.5	1.2
Existing Roadbed	1.4	–	3.1	0.1	3.3	0.1	2.6	0.1

Table 5-10a.–Proposed/recommended road improvements within riparian reserves and riparian corridors, by segment (miles)

	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
	Fish-Bearing Streams	All Other Riparian Features	Fish-Bearing Streams	All Other Riparian Features	Fish-Bearing Streams	All Other Riparian Features	Fish-Bearing Streams	All Other Riparian Features
Segment 1								
Spot	–	0.2	0.6	0.2	0.6	0.2	–	–
Contiguous	–	–	–	–	–	–	0.6	0.2
Segment 2								
Spot	0.1	1.0	2.7	1.4	0.1	0.9	0.2	0.3
Contiguous	–	–	0.8	0.2	–	0.2	3.6	1.5
Segment 3								
Spot	–	–	0.6	<0.1	0.1	<0.1	0.6	<0.1
Contiguous	–	–	0.1	–	0.1	–	0.1	–
Total [1]	0.1	1.2	4.8	1.8	0.9	1.4	5.1	2.0

(1) Due to rounding, the totals presented in this table may not correspond exactly with other tables.

Table 5-10b.–Proposed/recommended road improvements within riparian reserves and riparian corridors, by ownership (miles)

	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
	Fish-Bearing Streams	All Other Riparian Features	Fish-Bearing Streams	All Other Riparian Features	Fish-Bearing Streams	All Other Riparian Features	Fish-Bearing Streams	All Other Riparian Features
BLM								
Spot	0.1	0.7	3.3	1.1	0.7	0.7	0.2	0.2
Contiguous	–	–	0.7	0.1	–	0.1	4.1	1.2
PacifiCorp								
Spot	–	0.4	0.6	0.5	0.1	0.5	0.6	0.1
Contiguous	–	–	0.1	0.1	0.1	0.1	0.1	0.5
Total [1]	0.1	1.1	4.7	1.8	0.9	1.4	5.0	2.0

(1) Due to rounding, the totals presented in this table may not correspond exactly with other tables.

Table 5-11a.–Proposed/recommended road construction and decommissioning within riparian reserves and riparian corridors, by segment (miles)

	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
	Fish-Bearing Streams	All Other Riparian Features	Fish-Bearing Streams	All Other Riparian Features	Fish-Bearing Streams	All Other Riparian Features	Fish-Bearing Streams	All Other Riparian Features
Segment 2								
Construction	<0.1	0.1	0.1	<0.1	–	0.1	0.1	0.1
Decommissioning	–	–	<0.1	0.1	<0.1	<0.1	<0.1	–
Obliteration	2.6	1.0	4.4	1.3	5.6	1.5	3.1	1.1
Segment 3								
Construction	–	–	0.1	0.4	<0.1	0.1	0.1	0.4
Decommissioning	–	–	–	–	<0.1	0.6	–	–
Obliteration	–	–	0.4	0.1	0.6	0.1	0.1	0.1
Total [1]								
Construction	<0.1	0.1	0.2	0.4	<0.1	0.2	0.2	0.5
Decommissioning	–	–	<0.1	0.1	0.1	0.7	<0.1	–
Obliteration	2.6	1.0	4.8	1.4	6.1	1.6	3.2	1.2

(1) Due to rounding, the totals presented in this table may not correspond exactly with other tables.

Table 5-11b.–Proposed/recommended road construction and decommissioning within riparian reserves and riparian corridors, by ownership (miles)

	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
	Fish-Bearing Streams	All Other Riparian Features	Fish-Bearing Streams	All Other Riparian Features	Fish-Bearing Streams	All Other Riparian Features	Fish-Bearing Streams	All Other Riparian Features
BLM								
Construction	0.1	–	0.1	–	–	0.1	0.1	–
Decommissioning	–	–	–	–	–	0.3	–	–
Obliteration	2.0	0.6	2.5	0.8	3.6	0.9	2.0	0.6
PacifiCorp								
Construction	–	0.1	0.1	0.5	<0.1	0.1	0.1	0.5
Decommissioning	–	–	<0.1	0.1	<0.1	0.4	<0.1	–
Obliteration	0.7	0.4	2.4	0.6	2.5	0.7	1.2	0.5
Total [1]								
Construction	0.1	0.1	0.2	0.5	<0.1	0.2	0.2	0.5
Decommissioning	–	–	<0.1	0.1	<0.1	0.7	<0.1	–
Obliteration	2.7	1.0	4.9	1.4	6.1	1.6	3.2	1.1

(1) Due to rounding, the totals presented in this table may not correspond exactly with other tables.

Table 5-12.–Summary of road status[1] designations for roads within riparian reserves and riparian corridors, by segment (in miles)

	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
	Fish-Bearing Streams	All Other Riparian Features	Fish-Bearing Streams	All Other Riparian Features	Fish-Bearing Streams	All Other Riparian Features	Fish-Bearing Streams	All Other Riparian Features
Segment 1								
Open	2.9	0.4	2.7	0.3	1.0	0.2	2.7	0.4
Admin. Use	–	–	0.2	0.1	1.9	0.2	0.2	–
Segment 2								
Open	6.6	3.8	5.1	3.4	0.5	1.0	5.1	5.2
Seasonal Closure	0.7	1.1	0.5	0.7	3.1	2.9	1.0	0.1
Admin. Use	0.4	0.8	0.4	0.8	1.1	0.9	1.2	–
Segment 3 [2]								
Open	2.7	2.5	2.9	2.8	2.5	3.1	3.4	2.8
Seasonal Closure	–	–	–	–	–	–	0.3	0.2
Admin. Use	2.9	2.6	2.5	2.6	2.5	2.0	2.0	2.4
Total								
Open	12.2	6.7	10.7	6.5	4.0	4.3	11.2	8.4
Seasonal Closure	0.7	1.1	0.5	0.7	3.1	2.9	1.3	0.3
Admin. Use	3.3	3.4	3.1	3.5	5.5	3.1	3.4	2.4

[1] This table refers only to those roads that are open to public and/or administrative access for at least part of each year.
[2] With the exception of Topsy Road, roads on non-PacifiCorp private land in Segment 3 were assumed to be closed to use by the general public.

Table 5-13.–Proposed/recommended vegetation treatments within riparian reserves and riparian corridors (acres).

	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
	Fish-Bearing Streams	All Other Riparian Features	Fish-Bearing Streams	All Other Riparian Features	Fish-Bearing Streams	All Other Riparian Features	Fish-Bearing Streams	All Other Riparian Features
BLM								
Forest/Woodland	88	80	331	156	389	213	331	156
Dry Meadow/Shrub	2	32	32	102	47	117	32	115
Riparian	1	6	16	14	28	17	3	6
PacifiCorp								
Forest/Woodland	–	1	35	115	47	183	35	138
Dry Meadow/Shrub	–	–	25	37	30	112	31	83
Riparian/Irrigated	3	8	287	223	316	249	12	10
USFS								
Forest/Woodland	–	–	–	–	–	6	–	–
Riparian/Irrigated	–	–	–	–	–	2	–	–
Total								
Forest/Woodland	88	81	367	270	436	403	367	294
Dry Meadow/Shrub	2	32	57	139	76	229	62	198
Riparian/Irrigated	4	14	303	237	341	267	14	16
Grand Total	**94**	**127**	**727**	**646**	**853**	**899**	**445**	**508**

Table 5-14.–Effects[1] on Aquatic Conservation Strategy Objectives

ACS Objective	Alternative 1	Alternative 2	Alternative 3	Alternative 4
1	+	++	+++	++
2	+	++	+++	++
3	0	++	+++	0
4	+	++	++	+
5	0	++	+++	+
6	0	++	+++	0
7	0	++	+++	+
8	0	++	+++	+
9	+	++	+++	++

[1] The relative cumulative effect of the proposed alternatives on the nine ACS objectives is as follows:
"0" indicates that the objective would be maintained,
"+" indicates a slight degree of restoration,
"++" indicates a moderate degree of restoration, and
"+++" indicates an extensive degree of restoration.

Aquatic Species/Habitat

Assumptions/Impacts Common to All Alternatives

For the purposes of this analysis direct impacts are actions that immediately effect aquatic resources (USFWS 1998), actions that disturb an individual animal or alter temporal and/or spatial access to aquatic habitat during and upon completion of projects (i.e. installation of instream rock weirs may directly disturb fish and would immediately change the conditions of instream habitat). Indirect impacts are caused by or result from the proposed actions, are later in time, and are reasonably certain to occur (i.e. increased sediment delivery from native surfaced roads as a result of increased vehicular use within riparian areas would be reasonably expected to affect aquatic habitats).

Cumulative impacts to aquatic resources (discussed at the end of each alternative) are the additive result of all on-site proposed actions (within the planning area) and off-site actions that affect the overall quality, quantity, and stability of aquatic habitat. (For example, on-site actions such as installation of instream structures, the implementation of sediment augmentation, and stabilization of instream flows would collectively be expected to reduce channel width-depth ratios and increase availability and quality of instream habitats).

Off-site actions include those related to upper Klamath Basin water (both quantity and quality) and fisheries (both inland and anadromous fisheries) issues. While upstream impacts indirectly affect resources within the Planning Area, water and fishery proposed actions addressed in the River Plan do not have any direct or indirect impacts on the upper Basin situation. For example this plan would not influence the Bureau of Reclamation's Klamath River Anadromous Fish Restoration and Operation Plan, or the Environmental Protection Agency/State Total Maximum Daily Load development process.

Aquatic Species Populations (Including Threatened, Endangered and Sensitive (TES) Species): Monitoring of aquatic species including TES species is generally recommended in order to understand the impacts of proposed projects and the lack of actions on the populations of aquatic species. Developing information on distribution and abundance of native aquatic species over time would aid in this understanding.

Wild Trout Areas in Oregon and California: No proposed actions were intended to specifically alter the Wild Trout Area designations. The characteristics of the trout (wild, naturally spawned, and genetically unique) that lead to the Wild Trout Area designations in the Oregon and California reaches are not expected to change as a result of any of the proposed alternatives. The proposed aquatic habitat projects and instream flow recommendations within the Klamath River Management Plan would beneficially affect the trout populations for which the Wild Trout Area reaches were designated. The proposed changes in land tenure and the proposed river access trails would potentially increase utilization of the Wild Trout Areas in both reaches.

Turtle Camp Trail: Turtle camp trail has recently been re-opened and used as a vehicular road by recreation OHV users. This trail would be re-closed and maintained for non-motorized use under all alternatives. The existing trail is not directly adjacent to stream edges and has only limited impacts to the aquatic resources. In locations where the trail crosses drainages, use of the trail may locally increase sediment reaching stream channels. Implementation of best management practices pertaining to trail maintenance would be expected to limit impacts to aquatic habitats.

Rock Creek Bridge: Redesign (retrofit) of Rock Creek Bridge and river channel would occur under all alternatives. Fish do not occupy Rock Creek reaches affected by the proposed bridge and channel enhancements. Proposed improvements to route water under the bridge,

rather than down the roadbed, would be expected to improve aquatic habitat downstream by reducing sediment transmissions. However, short-term (first wet season) negative effects to aquatic habitat downstream of the bridge site may occur from sediment transport, as a result of in stream work.

Flow Regimes and Sediment Regimes: A variety of project proposals are identified within the various alternatives such as width treatments, side channel treatments, chute cutoff treatments, large and coarse wood treatments, and others. The success of these projects for achieving geomorphic and fisheries objectives is predicated on flow regimes and sediment regimes that will contribute to project stability and functionality. Spill releases function in two ways: first, they provide the stream energy necessary to move sediment (gravels) to and from project locations, and secondly, they provide stream energy sufficient to alter local channel morphology. Without spill releases from J.C. Boyle dam, to the bypass reach, and/or from the powerhouse, that can redistribute sediment within the planning area, the rate of recovery even with active instream work would be seriously delayed. Without spill releases sufficient to alter channel morphology, the rate of recovery for local aquatic habitat diversity would also be prolonged. Lack of sediment entrainment into the water column in these riverine reaches would also reduce the rate of marginal sediment deposition thus affecting rates of bank development and subsequent riparian vegetation recovery.

Use of Mechanical Equipment in Stream Channels: Short-term impacts due to use of equipment in the river will include displacement of existing riparian vegetation, bank soils, and channel substrates. Increased delivery of sediment within the river may occur during the first wet season after construction and would reduce as vegetative recovery occurs (Furniss et al 1991).

PacifiCorp Facilities and Operations: The existing hydroelectric facilities, above and below the Planning Area, negatively affect native fish movement to and from the planning area, sediment supply and transport through the planning reaches, and temperature stability. Without modification of existing facilities and change in operations of those facilities, access to and condition of important aquatic habitats within the planning area would continue to be limited.

No actions or projects were proposed to directly address anadromous fisheries migration through the lower dams of the Klamath Hydroelectric Project (FERC License #2082) as part of the Klamath River Management Plan. No proposed actions or projects were directly proposed to protect/enhance habitat in the Klamath Wild and Scenic River for listed anadromous species as part of the Klamath River Management Plan. In the event that passage of anadromous species is restored through the lower dams of the Klamath Hydroelectric Project (Iron Gate, Copco 1 and Copco 2 Dams) to the Klamath Wild and Scenic River planning area, then potentially 23 miles of anadromous habitat would become available for migration, rearing, and to a lesser extent, spawning habitat within the planning area. In addition, multiple rivers, streams, and springs above the planning area within the Upper Klamath River and Upper Klamath Lakes would also become available to anadromous species. Proposed actions intended to protect and enhance the ORV for fisheries resources, particularly Klamath redband trout, would be expected to beneficially affect the reintroduced anadromous species life-history components.

The emergency spillway located within the bypass reach of the planning area would be treated in to varying degrees under all alternatives. Current conditions are contributing to high sediment loading reaching the river channel immediately downstream of the site, particularly during spill. Efforts should be made to reduce or eliminate the occurrence of the emergency spillway use and protective measures would be conducted to prevent erosive sediments from the site reaching the stream channel.

The powerline system within the canyon is having minimal to no direct impact to the aquatic system. Indirect negative impacts may be occurring as a result of the power company's

efforts to maintain the powerlines and the interrelated/interdependent impacts to maintain the road network to service the lines.

Maintenance of roads in drainage bottoms could potentially result in surface erosion of sediment sources reaching stream channels (Furniss et al 1991). This potentially could affect aquatic resources by increasing sediment transmitted to the aquatic habitat. Increased fines in the river channel can result in increased percentage of substrate embeddedness.

Grazing Use: Livestock grazing can affect the riparian environment by reducing vegetation, and eliminating riparian areas by channel widening, channel aggrading, or lowering of the water table (Platts 1991). Riparian zones are often grazed more heavily than upland zones because they have flatter terrain, water, shade, and succulent vegetation. Reduction in ground cover vegetation and increase in compaction associated with livestock use causes increased runoff (see water quality) and can negatively affect aquatic habitats. No change in grazing management is proposed under this alternative. The existing impacts from grazing management of the BLM and PacifiCorp lands would be expected to continue.

Land Tenure: Both RMPs covering the planning area prescribe acquisition of private land within the Upper Klamath River ACEC (Oregon) and the Upper Klamath River Management Area (California). This would include any privately owned land parcels. The consideration to acquire land outside of the Upper Klamath River Management Area in California (acreage depends on each alternative) applies only to PacifiCorp land.

Impacts of Specific Alternatives

(Refer to Maps 25-28, and Appendix H)

Alternative 1

Scenery Management - Any scenery management actions conducted within the canyon would be completed in a fashion as to maintain the scenic qualities based on time of designation. As a result no ground and vegetation disturbing activities would occur within the river view and riparian reserves. No direct or indirect affects to aquatic resources are anticipated from scenery management under this alternative.

Recreation Facilities and Management - This alternative is the least impacting to riparian vegetation when compared to the other alternatives. Increasing the number of recreational facilities, as proposed in Alternatives 2 and 4, would have a greater negative impact habitat for aquatic dependent species. The existing and proposed enhancement of recreation facilities within the riparian reserves would result in a minor long-term negative impact to riparian vegetation and the connectivity to aquatic habitats (see Map 13). Human use may also have indirect impacts to aquatic resources due to firewood collection, reducing riparian CWD and thus indirectly affecting recruitment of CWD to stream channels.

Designated campsites without toilet facilities, or with improperly sited or designed facilities, could result in elevated releases of human waste contaminates to aquatic habitats (Clark and Gibbons 1991). The additive impact to the aquatic resources is uncertain. The impact to fish would result from direct impact to the fish, or indirectly from changes to their forage (Norris et al 1991). The toxicity of ammonia is dependent on pH, concentration of total ammonia, temperature, and ionic strength. Klamath basin water is generally high in pH prior to reaching the project area, and the reach is on Oregon's 303d list for temperature. In order to prevent cumulative impacts to the aquatic biota, efforts should be made to minimize risks by following RMP BMP guidance on campsite location and facility location.

The construction of the J.C. Boyle powerhouse and rock revetments to protect the powerhouse during peak flows, and construction of caretakers houses has substantively reduced quality of

the site for aquatic species. The development of an interpretive day use site at this location is not anticipated to have additional impacts to aquatic habitat.

Limited improvements to boating launching facilities may occur, however, no additional facilities would be constructed. Launch facilities are located within the riparian reserves of the Klamath River. These facilities would have continued negative impacts to aquatic system by disrupting the natural connectivity between the riparian and aquatic habitats and limiting development of riparian vegetation.

Within the planning area most of the existing trail lengths are located in the riparian reserves of the Klamath River (see Map 13). Trail maintenance typically includes cutting/bucking downed woody debris in order to provide unobstructed routes for human uses. Bucking of logs that could eventually reach to the river channel would be expected to reduce the stability of this CWD for creating/improving aquatic habitats. Larger wood would be expected to resist high flows and alter local channel morphology by creating scour pool and sediment depositional areas. Both these channel features are beneficial to aquatic habitat. Application of appropriate BMPs and PDF's to the existing trial network would be expected to protect riparian CWD and minimize the impacts to the aquatic habitats.

Three miles of new trail construction in riparian corridors would result in exposed soil and risk of erosion. The greatest risk of impacts is during the first wet season and would reduce as vegetative recovery occurs (Furniss et al 1991). Cutting downed logs during trail construction or maintenance reduces the value of the log as functional CWD for aquatic habitat.

Uses of uplands for recreational purposes (such as dispersed camping, and OHV use) would have limited impacts to the aquatic ecosystem. Some impact from upland OHV trails running through ephemeral channels, meadows, seeps and springs could result in the development of source areas for sediment transmission to aquatic habitats, particularly during wet periods (see Map 13 and Map 17a).

Road Management – This alternative would be expected to result in the fewest beneficial affects to aquatic habitat from proposed treatments to the existing road network within the Planning area when compared to Alternatives 2, 3, and 4. The proposed actions in this alternative provide a minimum level of stream crossing treatment in order to comply with ACS objectives consistent with the ROD and RMP (see Map 17a).

Most road management actions would be spot treatments having minor positive benefits by reducing sediment reaching aquatic habitats and fisheries. Road densities in riparian reserves are the highest in this alternative when compared to the other alternatives. Some roads removed from the base would be converted to hiking trails and would have reduced but continuing minor negative impacts to riparian and aquatic habitats.

The proposed stream crossing upgrades under this alternative would be expected to have short-term negative indirect impacts to aquatic habitat and aquatic species. Actions would be limited to dry season operations. Based on field review it appears that many affected reaches are intermittent in nature and that no fish species would be affected during construction. Construction actions within the streambed would disturb stream substrate, and potentially increase erosion by loosening riparian soils and stream banks. Increased sediment potentially would reduce habitat quality during the first wet season after construction. Seasonal restriction on instream work, and implementation of RMP BMPs and project PDF's would be expected to minimize negative impacts to the aquatic resources. Long-term enhancement of aquatic habitat would be expected as stream substrate, banks, and riparian habitats re-vegetate and stabilize. Improved stream crossings would provide better aquatic species access to upstream habitats and would be expected to reduce road surface erosion from reaching stream channels.

Bridges or abandoned bridge sites (abutments and footings) over the mainstem Klamath River and tributaries would not be altered under this alternative. Negative impacts to aquatic habitat (impaired width-depth ratio at and below the site) from the former bridge footings would continue.

Cultural Resource Management - No ground disturbing actions are proposed to protect, enhance or restore cultural resources, therefore, no impacts to aquatic resources are anticipated.

Vegetation Management - (Includes actions for fuels/wildlife habitat/silviculture/weed control.)

Riparian vegetation treatments: Vegetation treatments would not occur within the Klamath River riparian reserves. Some vegetation management may occur in tributary riparian reserves outside of the scenic river viewshed. Actions within these tributary riparian areas would be consistent with treatments described within the KFRA Fuels Management EA (BLM 1994) and the KFRA RMP.

Upland vegetation treatments: Vegetation treatments would continue based on existing management for the Scenic corridor of the Planning area, typically out of river view. Upland vegetation treatments would not be expected to impact the aquatic resources directly. Indirect impacts may result from increase road traffic on minimally maintained road surfaces, within the Planning area. Sediment transmission from the road surfaces to stream drainage may occur during the first wet season after use (Furniss et al 1991).

Terrestrial Species/Habitat Management - See discussion of vegetation management for proposed wildlife projects addressing the impacts to plant communities.

No negative impacts to aquatic resources from proposed non-vegetation based wildlife projects would be anticipated under this alternative. Some beneficial impacts to aquatic resources may be realized by maintaining wildlife based road closures. See road management sections for impacts to aquatic resources of proposed and ongoing road management for Alternative 1.

Watershed Management Actions - *Water quality/beneficial uses:* No substantial changes to water quality are anticipated from this alternative, and the associated effects on aquatic habitat would continue.

River flows and water rights: No changes in the flow regimes would be pursued as part of this alternative. The flows proposed within this alternative would continue to affect fish directly and indirectly (Tyrus 1990). Direct effects would include continued risk of stranding, and limitations in spawning activity. Indirect effects would include the continued loss of aquatic habitat and degradation of water quality.

Flow diversion from Segment 1 and ramping operations below the powerhouse would maintain the existing degraded aquatic conditions and species distributions. Diurnal fluctuation in water temperature of up to 12 degrees Fahrenheit would continue. The negative long-term impact to the aquatic resources from such temperature shifts would also be expected to continue. Impacts to fish may include temperature elevation beyond the range preferred for rearing, inhibition of upstream migration of adults, increased susceptibility to disease, reduced metabolic efficiency, and shifts in competitive advantage (Hicks et al 1991).

Altered riparian and geomorphic conditions resulting from peaking operations would continue. The lack of available riparian vegetation would continue to affect the aquatic species in the planning area, especially in Segments 2 and 3. Risk of fish stranding on point bars and side channels that are currently being dewatered during peaking operations would also continue.

Riparian function: See discussion of riparian vegetation treatments for effects to aquatic resources.

Aquatic Species/Habitat Management - *Sediment management:* No changes in sediment management would be pursued. Reaches of river below the J.C. Boyle Dam would remain gravel-limited. The impacts to aquatic species in the planning area due to the lack of spawning gravel recruitment and lack of sediment to aid in stream bank development would be expected to continue.

Instream structures: Instream structures (wood/rock, side channel/chute cutoff treatments, bridge sites, and width treatments) would not be placed as part of this alternative. Current channel widths would be anticipated to remain largely in their existing conditions. Existing lateral erosion evident within Segment 1 and 3 would continue to move until reaching a geomorphic limitation such as bedrock. Fisheries access to side channels and chute cutoffs, and inherent risk of fish stranding within these channels due to peaking, would not be changed under this alternative (see Map 25).

Bypass Canal waste treatments: Side cast material in the Bypass Reach would remain in place. Negative impacts to channel function, fish passage, and riparian development would continue. Flood plains with diverse riparian vegetation would not be expected to develop under existing situations. Constraint of the width to depth ratio would continue, thus resulting in high water velocities. High water velocities would maintain and in time increase channel widening, incision, and bed armoring which is currently impairing the bypass reach.

Irrigation diversion treatments: Maintaining the existing and historic irrigation diversions (mainstem and tributary) would be expected to maintain the existing negative impacts to the aquatic resources at the location of the diversion. Width to depth ratios of the river would not be expected to change as a result of this alternative. Mesohabitat types would remain in the current condition. Benefits to aquatic resources would not be anticipated from this action.

Maintaining the diversions of Shovel Creek reduces instream flow during temperature limiting summer months. Due to high water temperatures the Klamath River, tributary refugial areas are of greater importance within the planning area. Continued diversion of Shovel Creek limits the availability of important cold-water refugial habitat at the mouth and within Shovel Creek.

Range Management - Impacts from grazing are common to all alternatives, though Alternative 3 substantially reduces or eliminates grazing use on BLM land and recommends a similar actions for PacifiCorp land.

Fire and Fuels Management - Actions would be consistent with those riparian reserve prescriptions in the Fuels Management EA (BLM 1994). Randomly selected units within the fuels treatment program would continue to be treated, some units may include riparian reserves. Long-term positive impacts would be realized by reducing fuel loading thus protect riparian vegetative communities. This alternative would take the longest to complete fuel reduction in the canyon. As the RMP fuel management program is implemented across the resource area, untreated riparian areas with excessive fuel loading within the canyon would continue to be at a higher risk to stand replacement fires.

Land Tenure - Land acquisition as described in the Klamath Falls and Redding RMPs would be pursued under this alternative; no other acquisition would be pursued. No land conservation easements would be pursued as part of this alternative. The ability to administer the lands within the Klamath River planning area would generally remain as is. Independent efforts by the BLM and other landholders would largely form the basis for watershed level land management. The proposed land tenure adjustments, as described within the RMPs, would be expected to maintain the existing aquatic habitat conditions along the Klamath River. Shovel Creek, identified as the only spawning/rearing tributary in Segment 3, is at risk

to being sold by PacifiCorp to private developers. Without BLM acquisition, or developing riparian conservation easements, the development of riparian areas on PacifiCorp land along the Klamath River and Shovel Creek for agricultural and residential purposes would be expected to have a detrimental impact of riparian vegetation and the associated aquatic community.

Hydropower Facilities - *Power production facilities:* Fisheries attraction flows to the bypass reach and fish ladders would remain under current regimes. Similar to other hydroelectric facilities, transport of bed-load, suspended load, and coarse woody debris would be impaired as a result of this alternative, with most material being entrained within J.C. Boyle Reservoir (Stillwater Sciences 2000). Adverse conditions that contribute to poor movement of trout into and above the bypass reach would continue.

Actions to stabilize the emergency spillway and hill slope would likely prevent further degradation of the upper bench and hill slope leading to the river channel. Existing negative impacts to channel function and riparian development on BLM lands would continue.

Transmission lines and rights-of-way - No alterations to the powerlines within the canyon would be proposed.

Cumulative Impacts - No beneficial changes to the Klamath River geomorphology would be expected to occur under this alternative, and habitat value could continue to degrade (due to peaking operations and depletion of gravels). River bank development would not be expected to change due to the lack of riparian development (bankfull benches), continuation of existing flow patterns, and the lack of sediment in the system. The existing risk of fish stranding in side channels, chute cutoffs and point bars would continue. No additional habitats would be made available for fry or juvenile trout as a result of this alternative. Continued management of the river under the existing conditions would be expected to maintain the redband/rainbow trout in the reach in their current limited (or smaller) size classes. Largely due to the operation of power facilities this alternative will maintain the higher rate of downstream movement of fish versus upstream movement of fish.

This alternative would provide the fewest enhancements, and the least protection, to aquatic resources within the planning area in the short-term. There is an increased short-term risk of catastrophic fires impacting riparian habitats. The proposed flows associated with a lack of sediment recruitment may result in negative changes in aquatic habitats. Some improvement to aquatic habitat would occur as a result of water claims and long-term treatment of fuels within the planning area.

Alternative 2

Scenery Management - Limited vegetation management projects are proposed for scenic qualities. The actions proposed under other resources may affect scenic quality and thus scenic management may limit the scope of some projects within the canyon. No direct or indirect affects to aquatic resources are anticipated from scenic management actions proposed under this alternative.

Recreation Facilities and Management - The existing facilities within the riparian reserves disrupt natural habitat connectivity and limit vegetative community development at the site level and indirectly affect the quality and quantity of habitat for aquatic and riparian dependant species. The degree of impact to the riparian system per site varies based on the size of the site and the level of use the site receives.

The proposed location for the Shovel Creek camping facility is adjacent to the riparian corridor of the Klamath River and Shovel Creek on privately owned (PacifiCorp) irrigated pasture (see Map 14). The local vegetative community has substantially been altered from historic conditions; species present are predominately of pasture grass varieties with some

riparian dependant vegetation occurring adjacent to the riverbank. To be consistent with NFP and RMP direction, any new camping facility should be constructed outside these riparian corridors, or mitigation may be needed to retain functionality of the riparian reserves and meet ACS objectives. At this location, sitting camp units and support facilities at least 280 feet from the Klamath River and Shovel Creek would be necessary. Access to the river would be based on existing access point were feasible. Any additional access points should be designed so as to protect riparian vegetation and bank stability. Actions proposed that are beyond the extent of those impacts addressed here would need additional NEPA analysis.

Designated campsites without toilet facilities, or sites with improperly designed or sited facilities, could result in elevated releases of human waste contaminates to aquatic habitats (Clark and Gibbons 1991). The risk may occur as direct impacts on the fish or indirectly as impacts on their forage (Norris et al 1991). The additive impacts of Alternative 2 recreation actions on water quality to the aquatic resources are uncertain. In order to prevent cumulative impacts to the aquatic biota, efforts should be made to minimize risks by following RMP BMP guidance on campsite location and by providing restroom facilities where needed based on site usage. Human use may also have indirect impacts to aquatic resources due to firewood collection, reducing riparian CWD, and thus indirectly affecting recruitment of CWD to stream channels.

Construction of a primitive raft launch facility at J.C. Boyle dam would impact aquatic systems by disrupting the natural connectivity of aquatic habitat and the riparian community, limiting development of riparian vegetation, and creating routes for sediment to reach the river.

Several interpretive sites (J.C. Boyle Dam fish ladder, J.C. Boyle Powerhouse, Spring Island, Frain Ranch and Hoover Ranch) are proposed within the riparian reserves on the Klamath River. The interpretive site at J.C. Boyle Powerhouse would be located in a massively altered riparian area with reduced quality of the site for aquatic species and thus would not be expected to have additional impacts so long as all facilities are located on the existing rock and asphalt surfaces.

Construction of interpretive facilities at J.C. Boyle dam may affect the recovery of the vegetative community at the site. A non-hardened (native surface) parking area exists adjacent to the dam access road. Use of this area for parking and creating a trail on the existing native surface road leading to the base of the dam would be expected to have the least impact on the riparian community and thus the least impact on aquatic habitat.

Three miles of existing designated trails, plus over three miles of existing road beds would be maintained as trails under this alternative (refer to Table 5-9). Within the planning area most trail lengths are located in the riparian reserves of the Klamath River (see Map 14). The existing Turtle Camp trail is not directly adjacent to the river edge and has only limited impacts to the aquatic resources. In locations where the trail crosses drainages, use and maintenance of the trail may locally increase sediment reaching stream channels. Implementation of best management practices pertaining to trail maintenance would be expected to limit impacts to aquatic habitats.

Over 17 miles of new trail is proposed to be constructed on and immediately adjacent to riparian reserves under this alternative (refer to Table 5-9), which may impact aquatic habitats. Exposed surfaces (non-vegetated and/or hardened) would be at risk to erosion during the wet season (Furniss et al 1991). The exposed surfaces would potentially increase risk for erosion along the length of trail on the bench. Trail construction would generally include cutting/bucking downed woody debris in order to provide unobstructed routes for human use. Bucking of logs that may reach to the river channel would be expected to reduce the value of these CWD for creating/improving aquatic habitats. Larger wood would be expected to resist high flows and alter local channel morphology by creating scour pool and sediment depositional areas. Both these channel features are beneficial to aquatic habitat.

Flows that enhance recreational rafting and recreational fishing would be pursued under this alternative. See Watershed Process discussion for impacts of varying flows on aquatic resources.

Minimal impacts to the aquatic ecosystem would be anticipated as a result of the proposed upland recreation projects under this alternative. Some impact to canyon drainages may result from upland OHV trails running through ephemeral channels, meadows, seeps and springs. This type of disturbance may result in development of source areas for sediment transmission to aquatic habitats, particularly during wet periods.

Road Management - *Road treatments within riparian reserves:* Approximately seven miles of road would be improved within the riparian reserves under this alternative. Actions would be conducted in order to maintain or enhance existing road networks or to maintain and enhance ACS objectives (Tables 5-10a and 5-10b). The majority of road miles treated in the riparian reserves would be spot treatments or decommissioning (see Map 18a).

Short-term impacts from road decommissioning (Tables 5-11a and 5-11b) could include increased erosion during the first wet season from loosened soils (Furniss et al 1991). Sediments eroded from exposed and ripped road surfaces potentially could reach stream channels. Fine sediment particles in the river and fish bearing streams would impair aquatic habitat recovery, by increasing sediment embeddedness, and reducing subsurface percolating flows. Surface erosion would be expected to abate over time through natural revegetation.

Road networks can accelerate peak flows in small watersheds due to road network increasing the effective drainage network of a watershed (Marcus et al 1990). Reductions in road density through decommissioning would reduce exposed surface area for potential surface erosion, improve surface drainage of roads outside of draws, and increase infiltration of water to subsurface layers, thus reducing ditchline runoff and the potential transport of sediment to riparian and aquatic habitat (Furniss et al 1991, Chamberlin et al 1991). Overall road densities in the riparian areas would be expected to decrease somewhat under this alternative, thus positively affecting peak flow patterns and sediment patterns in the river and fish bearing tributaries.

The proposed maintenance of discrete segments of planning area roads would be expected to reduce sediment production from these road surfaces (Furniss et al 1991). This would in turn improve local water quality in tributary stream that may be affected by these treatments. Local benefits to aquatic species may occur in locations of spot treatments, as reducing sediment loads in the tributary stream would be expected to reduce impacts to the aquatic habitat. Mainstem water quality is not likely to be substantively affected due the small percentage of road treatment proposed under this alternative and the extent of watershed upstream of the planning area.

Stream crossing upgrades within riparian reserves: The proposed stream crossing upgrades under this alternative would be expected to have short-term negative indirect impacts to aquatic habitat and aquatic species. Actions would be limited to dry season operations so no aquatic species would be present during construction. Construction actions within the streambed would disturb stream substrate, and potentially increase erosion by loosening riparian soils and stream banks (Furniss et al 1991). Increased sediment potentially would reduce habitat quality during the first wet season after construction. Long-term enhancement of aquatic habitat would be expected as stream substrate, banks, and riparian habitats re-vegetate and stabilize. Improved stream crossings would provide better aquatic species access to upstream habitats and would be expected to reduce road surface erosion from reaching stream channels.

Bridge treatments and upgrades (Rock Creek, Upper Frain, Lower Frain, Stateline): Upper Frain Ranch and Stateline bridge sites have created flow constrictions, increasing water velocities and subsequently altering channel features, such as width to depth ratio and

sediment transport (Rosgen 1996). The downstream channels have higher width to depth ratios (reduce water depths), which negatively affect the local aquatic habitat. Structural enhancement of the banks and adding bank full benches within the bridge's area of influence of the river channel, will improve channel function locally. Increasing span length, or designing bridge abutments to be isolated during high flows would aid in hydrologic function at the site. Increases in flood plain connectivity to the river channel would reduce channel stress from concentration of flow during peak flow events.

Peaking operations make edge habitat only available for short periods of time during low flow periods. Overhead cover including undercut banks, overhanging vegetation, logs, and debris jams are typically important fish habitat in streams (Bjornn and Reiser 1991). Fish within the degraded reaches are limited in accessing these overhead cover habitat types. Efforts to design bridge sites with lower width to depth ratios and enhanced floodplain function would reduce impacts of peaking flows on aquatics species by increasing accessibility of overhead cover habitats.

Improving the abandoned Frain Ranch bridge site would aid in narrowing the active channel width both above and below the site. Reducing the width to depth ratio at this location would increase water depth and provide more available habitat during low flow periods.

Altering the abandoned Stateline bridge site would aid in allowing natural flood inundation at bank full flows. This would reduce channel velocities downstream of the bridge site and improve aquatic habitats.

Redesign of Rock Creek bridge and river channel would occur under this alternative. Fish species do not occupy Rock Creek reaches affected by the proposed bridge and channel enhancements. Proposed improvements to route water through the bridge, rather than down the roadbed, would be expected to improve aquatic habitat downstream by reducing sediment transmissions. However, short-term (first wet season) negative affects to aquatic habitat downstream of the bridge site may occur from sediment transport, as a result of in stream work.

Road treatments upland (decommissioning/closure/upgrade): Limited improvement of the upland road network is proposed under this alternative (see Map 18a). Most actions are identified as a means of improving watershed processes, to maintain the existing road network, and meet identified objectives within the RMP. These proposed projects are not anticipated to directly affect the aquatic resources of the canyon. Reduction in road densities in the canyon and improvement of drainage features for the road lengths potentially could provide indirect long-term benefits to the aquatic resources.

Cultural Resource Management - *Interpretive sites:* Interpretive sites are proposed for the cultural and historic resources of the canyon along Topsy Grade, and Beswick. See Recreation Resources affects analysis for impacts of interpretive site construction for impacts to aquatic resources (see Appendix H).

Site protection actions: Actions to protect prehistoric cultural resource sites within the riparian reserves of the canyon include capping of sites with surfacing materials such as crushed gravel, boulders, and/or dirt fill. Placement of these materials near or adjacent to the river channel could result in a short-term increase in fine particulates reaching aquatic habitat. As vegetative recovery takes place and the initial washing of surface sediment occurs the extent of this impact would be minimal.

Proposed fencing actions would not be expected to generally affect aquatic habitat. Fencing actions proposed to protect cultural sites may have an indirect beneficial affects to riparian resources and aquatic habitat.

Vegetation Management - *Riparian vegetative treatments:* Proposed vegetation treatments that would increase the vegetative diversity, reduce fuel loading to reduce risk of catastrophic fire, and enhance riparian stands to accelerate CWD recruitment to stream channels, would have the greatest value to aquatic resources. A range of actions would occur under this alternative in the riparian reserves from mechanical and hand thinning, mechanical and hand piling, pile burning, and broadcast burning (see Map 22). In riparian reserves the individual proposed treatments would be designed to meet the Aquatic Conservation Strategies and would be reviewed for consistency with River Plan Objectives and resource objectives by the KFRA riparian team and the KFRA ID team.

Indirect impacts to aquatic habitats from riparian vegetation manipulation could result from actions proposed within this alternative. Removal or reduction in the riparian canopy could produce an increase in summer temperatures and a decrease in winter temperatures (Marcus et al 1990). Cumulative impacts to fishery resources of increased stream temperatures can include chronic stress and reduce fishery productivity from exposure to elevated sub-lethal temperatures. Larger streams, such as the mainstem river reaches in the planning area, would be more affected by removal of the taller vegetation within the riparian areas and less affected by understory treatments. In addition, reduced canopy cover can reduce inputs of organic debris and invertebrates from overhanging branches, thereby reducing forage available to aquatic species.

Indirect effects of vegetative management may also occur as a result of using mechanical equipment in the riparian reserves. Road surfaces, landings, skid trails, ditches and disturbed cut areas can alter pathways water takes to stream channels, alter peak flows, and contribute sediment to stream channels (Chamberlin et al 1991). Changes in flow patterns and increased sediment transport would cause negative impacts to aquatic habitat and aquatic species.

Minimal harvesting and non-commercial treatments within the riparian reserves where CWD needs are met, and actions that maintain or contribute to improving riparian and channel function are not expected to have short-term negative impacts to the aquatic resources. Locating mechanical treatments outside the no-entry buffers, and following recommended PDF's, are anticipated to minimize compaction, soil displacement, and reduce surface erosion reaching the stream channel. Application of manual non-commercial treatments located within the no-entry buffer designed to control stocking, reestablish and manage stands and acquire desired vegetation characteristics to meet ACS objectives, are not expected to negatively affect the aquatic resource in the short-term. Implementation of this alternative with the application of the identified mitigation and appropriate KFRA RMP BMP's and the described PDF's are expected to minimize short-term impacts to aquatic resources. In the long-term restored and/or maintained riparian forest stand health would be anticipated to maintain, protect and restore aquatic resources. Alternative 2 proposed treatments would be expected to improve riparian habitat over existing conditions and reduce risk of catastrophic fire similar to actions proposed under Alternative 4, but the extent of protection would be less than Alternatives 3.

Upland vegetative treatments: Proposed upland actions would primarily revolve around thinning and fuel reduction treatments (see Map 22). Upland vegetation treatments would not be expected to directly impact the aquatic resources. Indirect negative impacts from heavy use by logging trucks on the Planning area road network may occur, resulting in elevated sediment production (Chamberlin et al 1991). Increased sediment transmission from road surfaces to stream drainages may occur during the first wet season after treatments, and would reduce as vegetative recovery occurs (Furniss et al 1991).

Terrestrial Species/Habitat Management - No negative impacts to aquatic resources from proposed non-vegetation based wildlife projects would be anticipated under this alternative. Some beneficial impacts to aquatic resources may be realized by maintaining wildlife-based road closures. See road management sections for impacts to aquatic resources of proposed and ongoing road management for Alternative 2.

Watershed Management Actions - *Water quality/beneficial uses:* Alterations in water releases from the hydroelectric facilities would be pursued in order to minimize water quality impairment as a result of annual and daily alterations of the hydrograph. Changes in water release patterns from either the powerhouse or dam would be pursued to reduce temperature gradients. Stream temperatures, which are in part determined by instream flow releases from project dams, are known to strongly influence trout growth (Stillwater 1999). Factors limiting the growth of older trout are not known, but both temperature and food likely affect growth rates. Reduction in daily fluctuations in temperature would be expected to beneficially affect the aquatic species. Biological factors potentially affected, include aquatic habitat, migration, disease resistance, metabolic efficiency, and competition (Hicks et al 1991). Specific fish response may vary depending on species, and location in the river.

Negative impact of altering flows may include increased duration of chronic stress from exposure of fish species to consistently higher temperatures. Refugial habitats from tributary inflow, such as Shovel Creek, may become more important. The proposed instream enhancements, increased pool depths and reduced width to depth ratios, would result in increased habitat complexity which may offset some impacts of exposure to chronic temperature regimes (Poole et al 2001).

River flows: Alterations to instream flow would be pursued in order to enhance fishery and recreational resources. Enhancement of flows under this alternative would assume an increase in base flow during critical summer months both in the bypass reach and below the powerhouse. Stream flows that increase accessibility to overhead cover including undercut banks, overhanging vegetation, logs, and wood jams would enhance fish habitat (Bjorn and Riser 1991). Recommendation that stabilize flows, reduced peaking or run of the river, in tandem with sediment augmentation would be anticipated to foster vegetative growth along the bank and aid toward narrowing the active channel widths, thus improving overhead cover habitat. Stabilizing flows would be expected to result in greater primary production and macro-invertebrate production thus resulting in increased food sources for native fish species (Stillwater 1999).

Continuation of flow diversion from Segment 1, plus ramping/peaking operations below the powerhouse would continue to maintain much of the existing degraded aquatic conditions and species distributions. Diurnal fluctuation in water temperature would continue, but the overall magnitude of daily fluctuations as well as the gradient in the vicinity of the powerhouse would be reduced as a result of increased base flow in the bypass reach. The negative long-term impact to the aquatic resources from such temperature shifts would be reduced. However, impacts to fisheries would continue, including, elevation of temperatures beyond the range preferred for rearing, inhibition of upstream migration of adults, increased susceptibility to disease, reduced metabolic efficiency, and shifts in competitive advantage (Hicks et al 1991).

Conflicts exist between optimal flows for recreational rafting and aquatic resources. Efforts to maintain suitable of daily/seasonal rafting opportunities may come into direct conflict with beneficial flow for aquatic species. The proposed peak flows, for rafting opportunities in Segment 2 and 3, would limit recovery and enhancement of riparian vegetative and maintain widened channels (Marcus et al 1990). The lack of available riparian vegetation would continue to affect the aquatic species in the planning area. Risk of fish stranding on point bars and side channels that are currently being dewatered during peaking operations would continue, however the quantity of area and the rate of flow change would be reduced and thus lessen the impact from existing conditions.

Riparian function: See discussion of riparian vegetation treatments for effects to aquatic resources.

Aquatic Species/Habitat Management - *Sediment Management:* Sediment enhancement would be implemented to replace sediment that has been captured by the project facilities

(Link River dam to J.C. Boyle Dam) and are no longer available to the river channel. Sediment replenishment would enhance instream projects, bank development, and provide additional spawning habitat for native species (trout). The deposition/distribution pattern of additional gravel would largely be based on stream gradient and morphology (Rosgen 1996). In steeper gradient stretches little gravel deposition would be expected to occur, where channel velocities high. In lower gradient stretches such as the Frain Ranch area, and in Segment 3, substantial changes in point bar deposition patterns would be expected to occur. Sediment enhancements would aid in recovery of riparian vegetation by providing rooting areas for riparian species such as willow, alder, cottonwood, sedges, reeds and rushes. Enhanced/recovered riparian vegetation would increase bank strength due to deeper/higher strength root masses and potentially result in bank building (Platts 1991, Marcus et al 1990). Increased riparian vegetation along the river edge would trap fine sediments and contribute to reductions of embeddedness of the larger sediment particles in channel. Bank building may result in narrowing the river channel and reducing the width to depth ratio. Bank vegetation and release from bank water storage, hyporheic flows, would enhance water quality (Poole and Berman 2002), thus providing additional edge aquatic habitats along much of the length of the river during temperature limiting periods in the summer.

The moderate level of sediment regime enhancement proposed would not be expected to substantially contribute to aquatic habitat recovery and enhancement associated with other proposed actions (alteration in flow regimes, bankfull bench installation, cutoff treatments, and channel width treatments).

Instream structures (wood/rock, side channel/chute cutoff treatments, bridge sites, and width treatments): Treating locations with wide channel widths and shallow depths would be anticipated to improve local aquatic habitat (see Map 26). Narrow single thread channels would enhance instream cover to aquatic species and reduce risks of stranding. Cross sectional morphology of stream channels influences the likelihood of stranding (Stillwater 1999). Channels with an abundance of shallow habitat are more likely to have larger areas exposed during down ramping where fish could become separated from the main river flow due to declines in stage.

Proposed channel structures include one or multiple, wing deflectors, “j”-hook type structures, or “w” type channel structures (Rosgen 2001). These structures would aid in formation of mid-channel pools by increasing local shear stress to the existing riverbed and would act as sediment storage areas upstream of the structure. Combined with a sediment replenishment program these structures would then also potentially create spawning habitat for native fish species.

Some treatments in the mainstem channel could incorporate coarse woody debris (CWD). Most treatment with wood in the mainstem would be placement of the wood along the riparian bank edge. In larger stream types, increases in coarse woody debris would block side channels, and create scour pools in the main channel (Murphy and Meehan 1991). Increases in CWD that contribute to logjams in the planning area would enhance the complexity of secondary channels and offchannel sloughs and marshes, effectively increasing habitat complexity and total rearing area. Assuming a sediment augmentation program is implemented sediment deposition potentially may occur upstream or downstream of the log depending on it’s placement in the channel.

The proposed tributary CWD enhancements would be expected to enhance channel morphology, increase retention of organic matter and provide essential aquatic habitat (Murphy and Meehan 1991). Sediment deposition associated with CWD can lead to formation of terraces, thus increasing the size of riparian areas (O’Connel et al 2000). Increased habitat complexity and enhanced riparian vegetative cover would be expected to improve water quality in tributaries such as Hayden Creek or the mouth of Edge Creek, and improve aquatic habitat of resident fish in these systems.

Treatment of side channels/chute cutoffs to limit high flows in these secondary channels would reduce the risk of fish stranding, particularly during hydropower peaking operations. Limiting flow in these cutoffs would concentrate main channel flow, resulting in increased channel velocities in the primary channel. The desired channel response would include increased channel depth and reduced width to depth ratios. The total area of aquatic habitat available for occupancy would be reduced, however the quality and diversity of habitat would be increased.

The proposed treatment of side channels and rerouting the stream channel without a thorough understanding of the site-specific process that formed the channel features may result in negative impact on channel function (Rosgen 1988). Potential site-specific processes would need to be addressed (including meander geometry related to stream size, stream features such as riffle/pool sequences, and hydraulic geometry relationships) in order to protect the channel function. Taking into account channel functions and implementing the proposed river width adjustments, proposed augmentation of sediment (gravel), and proposed instream flows with the treatment of these side channels would be expected to protect and enhance the channel and result in enhanced aquatic habitat diversity.

Long-term beneficial impacts to aquatic resources would be expected from all proposed instream structures, which would enhance channel function, increased hyporheic connectivity, and increase instream habitat complexity.

Bypass canal sidecast actions: Installation of bankfull benches along sections of Segment 1 and removal of side cast within the river channel that is impairing fish passage would alter habitats along approximately 1.25 miles of riverbank. The elevation of these benches would be designed for the average annual peak flow return interval, typically a 1.1 to 1.8 year event, in order to maintain the river continuum for hydrologic function (Rosgen 1998). Placement of bankfull benches along 1.25 miles of the rivers edge dominated by boulder side cast would provide at least some bank stability and a minimal area for riparian vegetation recovery. Installation of bankfull benches with a coordinated transplanting of willow to these bank full benches would be expected to increase the overhanging vegetation along the river edge. Increasing overhead cover habitat would be partially contingent on a sediment replenishment program to provide necessary materials to establish and enhance the bankfull terraces for developing new riparian vegetation (O'Connel et al 2000). In combination, these actions would provide cover habitat for fish species that otherwise doesn't exist in Segment 1 (see Map 26). Additional food sources for aquatic species would also become available from overhanging vegetation through organic matter, such as leaves, insects, and detritus, falling to the river waters (O'Connel et al 2000).

Irrigation diversion treatments (mainstem and tributary): Structural enhancements of all irrigation diversions to improve (reduce) the width to depth ratios of the Klamath River in the Planning area would improve aquatic habitat. Proper design of diversions can also lead to development of pools downstream of the diversion, which also function as aquatic habitat (Rosgen 2001). This action combined with a sediment replenishment program would also be expected to enhance spawning habitat, the structures would function as catchments for gravel-sized bedload.

Range Management - The recommended grazing action on PacifiCorp lands, including deferring grazing until minimum resource condition thresholds are achieved, would be expected to reduce impacts to riparian and aquatic habitats and potentially achieve some degree of recovery within these affected habitats.

Fire and Fuels Management - Extensive use of prescribed fire would occur within the planning area to reduce fuel loads, and to improve plant and wildlife diversity. Most fuel management actions would occur in tandem with proposed vegetation enhancement or constitute a vegetation treatment. Impacts from these types of actions on aquatic resources are described in the Vegetation Management sections. Prescribed fires ignited outside the

riparian reserves that are allowed to back into the riparian reserves are not expected to directly negatively affect the aquatic resources.

Contamination of riparian and aquatic habitat from use of volatile chemicals such as gasoline, kerosene, or diesel fuel may occur (as a result of leakage, spill, etc) during fuel management actions within riparian areas. These ignition chemicals have great potential for indirectly negatively affecting aquatic communities and salmonid habitats (Norris et al 1991). With adaptive management in use of ignition fuels, based on transmission potential of the chemical and the buffer distances from streams, the risk to aquatic habitat can be greatly reduced. Implementation of the proposed actions with the application of the identified mitigation and appropriate KFRA RMP BMP's and the described PDF's are expected to the minimize short-term risk of exposure to aquatic resources.

Land Tenure - Implementation of cooperative management agreements, land acquisition, and or land conservation easements would enable the BLM (and cooperators) to administer the lands within the Klamath River planning area to achieve landscape level resource objectives and maintain and enhance resource values. The ability of the BLM to enhance aquatic habitats in the planning area would be expected to improve, through ownership of the lands and would allow a greater range of projects to be implemented, with less administrative clearance needed. Potential land tenure adjustments would eliminate the possibility of residential development of riparian lands within Segment 3. Management of PacifiCorp lands consistent with BLM goals and objectives would be anticipated to enhance and recover aquatic habitat though changes in land use and restoration of riparian habitats.

Hydropower Facilities - *Power production facilities:* Enhancement of flow releases from facilities associated with J.C. Boyle Dam would be pursued under this alternative. The proposed alteration in flow regimes at the powerhouse and changes in spill at the dam would reduce thermal gradients between the Segment 1 and Segment 2, and reduce temperature fluctuations in Segment 2 and 3.

Alteration of fish passage facilities and augmentation of unscreened spill at the J.C. Boyle dam would also be pursued, and would be expected to improve fisheries connectivity between the planning area and upstream habitats. The configuration of the ladder including gradient and fish way entrance is not ideal, and attraction to the ladder is impaired (FishPro 2000). The proposed enhancement of the fish ladder and attraction flow at J.C. Boyle Dam would be expected increase upstream movement of adult fish, currently occupying habitat in planning area reaches of the Klamath River, to important spawning, rearing, foraging areas in the upper river, including Spencer Creek. The proposed increase of unscreened spill from J.C. Boyle dam would enhance unobstructed downstream movement of juvenile salmonids and prey fish into the planning area.

Stabilization of the emergency spillway and implementation of structural controls would likely prevent further degradation of the upper bench and hill slope leading to the river channel. Actions to improve the riparian and channel function impaired by use of the spillway improve aquatic habitats. Channel function and riparian development would be expected to experience some degree of recovery under this alternative.

Transmission line rights-of-way (wildlife proposals): Alterations to the powerlines within the canyon would be proposed in order to enhance the wildlife resources, however, minimal ground disturbing actions are proposed. Maintaining a road network in the canyon to service the transmission line could result in a long-term negative affect to aquatic resources. Erosion of fine sediment to the river channel can result in increased substrate embeddedness and a reduction in aquatic habitat quality for incubation, rearing and forage.

Cumulative Impacts - Changes to the Klamath River geomorphology would be expected to occur under this alternative. River bank development would be expected to change due to the alteration of flow patterns, and augmentation of sediment in the system and implementation of

instream projects. Fish stranding would be expected to be reduced as side-channels, chute cutoffs and exposed point bars, which increase stranding risk, would be reduce or eliminated.

Depending of future operations of hydropower facilities proposed actions would reduce the unbalanced longitudinal connectivity, the rates of downstream movement would be similar to upstream movement of fish, and in general, both migratory rates would be higher than under current regimes.

It would be expected that changes in temperature regimes, improvement in flow regimes, enhanced connectivity between the Keno Reach and the Planning area, changes in channel function, and increased reach habitat complexity would beneficially affect the native species. The proposed enhancement of the mainstem channel and tributaries would be expected to improve habitat quality for fry, juvenile, and adult trout. As habitat conditions improve and connectivity improves longitudinally and laterally, the potential would exist for beneficially altering the relative abundance and size class distribution for native species. However, the continuation of ramping/peaking in the planning area would be expected to continue to limit lateral connectivity, reducing the duration of access, to some extent to cover habitats for forage species and fry and juvenile life stages.

This alternative would have greater beneficial affects on aquatic species and habitats than Alternative 1 and 4, but due to continued peaking for rafting, the extent of benefits as those in Alternative 3 would not be achieved.

Alternative 3

Scenery Management (Overlooks, River Corridors) - Limited vegetation management projects are proposed for scenic qualities. The actions proposed under other resources may affect scenic quality and thus scenic management may limit the scope of some projects within the canyon. No direct or indirect effects to aquatic resources are anticipated from scenery management under this alternative.

Recreation Facilities and Management - Proposed recreation actions would have the least impact to aquatic resources under this alternative. The proposed actions to reduce the available recreational opportunities in the canyon would be expected to have direct and indirect negative and beneficial impacts to the aquatic resources (see Map 15).

Maintaining the existing facilities within the riparian reserves disrupts natural habitat connectivity and limits vegetative community development at the site level. The degree of impact to the riparian system per site varies base on the size of the site and the level of use the site receives. The existing camping and recreational developments within the riparian reserves limit available habitat for aquatic and riparian dependant species.

Reduction in the number of recreational sites would be expected to reduce access along the riparian edge. Limited or reduced river access opportunities would be expected to reduce impacts to the aquatic resources.

Indirect impacts may result from increased or even static levels of recreational use due to the removal of fire rings and designated campsites in and adjacent to the riparian reserves. A lower potential for ignition of fuels within the canyon could result from decreased recreational use. Until full fuels management actions have been completed, both the riparian and upland habitats would still be at higher risk of catastrophic fires. As vegetative stands are treated for fuels loading the extent of risk due to human induced ignition would be reduced.

More dispersed non-hardened access trails may become established, and these exposed surfaces (non-vegetated) would be at risk to erosion during the wet season (Furniss et al 1991). Increased human use without toilet facilities, or sites with improperly designed or located facilities, could result in elevated releases of human waste contaminates to aquatic

habitats (Clark and Gibbons 1991). The risk to fish may be result from direct impact on the fish or indirect impacts on their forage (Norris et al 1991). Human use may also have indirect impacts to aquatic resources due to firewood collection, reducing riparian CWD and thus indirectly affecting recruitment of CWD to stream channels. In order to prevent cumulative impacts to the aquatic biota, efforts should be made to minimize risks by following RMP BMP guidance, appropriate levels of monitor for usage, and adaptively managing resources based on use impacts.

No new recreation sites would be pursued under this alternative, thus no additional impacts to aquatic habitat would be expected.

Two interpretive sign installations are proposed under this alternative, at Spring Island and Frain Ranch. These proposed interpretive sites are located within the riparian reserves on the Klamath River. Sign locations would be in areas already affected by recreational and vehicular uses and these actions would not contribute additional impacts to riparian reserves.

Approximately 3.5 miles of existing designated trails, plus an additional six miles of new trails, would be maintained under this alternative (see Table 5-9). Within the planning area most trail lengths are located in the riparian reserves of the Klamath River (see Map 15). The existing Turtle Camp trail is not directly adjacent to the river edge and has only limited impacts to the aquatic resources. In locations where the trail crosses drainages, use and maintenance of the trail may locally increase sediment reaching stream channels (Furniss et al 1991). Implementation of best management practices pertaining to trail maintenance would be expected to limit impacts to aquatic habitats.

Approximately four miles of the existing road network along the riparian reserves of the canyon would be converted to hiking trails (see Table 5-9). Impacts from these "new" trails would be similar to those impacts described for existing trails (see Map 15). Some beneficial impacts of road to trail conversion may occur. Hiking trails limit the depth and extent of soil compaction as compared to vehicular access. Road width would be reduced to approximately one half the surface width of vehicular roads to accommodate the hiking/non-motorized trail. This would effectively reduce impacts by an almost equal measure. Ripping extraneous road surface area to improve soil and hydrologic function would be recommended. Conversion of roads to hiking trails would also expand the available surface area for riparian vegetation development. Recovery of riparian vegetation on old road surfaces would be expected to increase surface roughness increasing fine sediment capture. Reductions in surface runoff volume/rate may occur and reduction in sediment transmission to draws and stream channels would be expected to occur. This would in turn reduce the impacts of fine sediment reaching aquatic habitat from existing conditions.

Flows that enhance recreational fishing would be pursued under this alternative. See Watershed Process discussion for impacts of varying flows on aquatic resources.

Minimal impacts to the aquatic ecosystem would be anticipated as a result of the proposed upland recreation projects under this alternative. Some impact to canyon drainages may result from upland OHV trails running through ephemeral channels, meadows, seeps and springs. This type of disturbance may result in development of source areas for sediment transmission to aquatic habitats, particularly during wet periods (Furniss et al 1991).

Road Management - *Road treatments within riparian reserves (improvement/ decommissioning/closure):* Approximately nine miles of road would be affected within the riparian reserves under this alternative, actions would be conducted in order to maintain or enhance ACS objectives, scenic values, or fish and wildlife values (Tables 5-10a and b and 5-11a and b). The dominant road treatment proposed in the riparian reserves would be decommissioning and obliteration (see Map 19a).

Short-term impacts from road decommissioning and obliteration could include increased erosion during the first wet season from loosened soils (Furniss et al 1991). Erosion of exposed and ripped road surfaces potentially could reach stream channels. Fine sediment particles in the river and fish bearing streams would impair aquatic habitat recovery, increase sediment embeddedness, and reduce subsurface percolating flows. Surface erosion would be expected to abate over time through natural revegetation.

Road networks can accelerate peak flows in small watersheds due to road network increasing the effective drainage network of a watershed (Marcus et al 1990). Reductions in road density through decommissioning and obliteration would reduce exposed surface area for potential surface erosion, improved surface drainage of roads outside of draws, and increased infiltration of water to subsurface layers, thus reducing ditchline runoff and the potential transport of sediment to riparian and aquatic habitat (Furniss et al 1991, Chamberlin et al 1991). Overall road densities in the riparian reserves would be expected to decrease somewhat under this alternative, thus positively affecting peak flow patterns and sediment patterns in the river and fish bearing tributaries.

The proposed implementation of administrative use seasonal closures (see Map 19b) of unsurfaced and low use roads within the planning area would protect these road surfaces during the wet season thus reducing the potential and extent of surface erosion reaching stream channels (Furniss et al 1991).

The proposed maintenance improvement of roads would be expected to reduce sediment production from these road surfaces (Furniss et al 1991). This would in turn improve local water quality in tributary stream that may be affected by these treatments. Localized benefits to aquatic species would occur, by reducing sediment delivery to aquatic habitats. Mainstem water quality is not likely to be substantively affected due the small percentage of road treatment proposed under this alternative and the extent of watershed upstream of the planning area.

Stream crossing upgrades: The proposed stream crossing upgrades under this alternative would be expected to have short-term negative indirect impacts to aquatic habitat and aquatic species. Actions would be limited to dry season operations so no aquatic species would be present during construction. Construction actions within the streambed would disturb stream substrate, and potentially increase erosion by loosening riparian soils and stream banks (Furniss et al 1991). Increased erosion potentially would reduce habitat quality during the first wet season after construction. Long-term enhancement of aquatic habitat would be expected as stream substrate, banks, and riparian habitats re-vegetate and stabilize. Improved stream crossing would provide better aquatic species access to upstream habitats and would be expected to reduce roadbed sediment from reaching stream channels.

Bridge treatments and upgrades (Rock Creek, Upper Frain, Lower Frain, Stateline): Upper Frain Ranch and Stateline bridge sites have created flow constrictions increasing water velocities adjacent to and below the site and subsequently over-widened channels downstream, such as width to depth ratio and sediment transport (Rosgen 1996). Lower Frain Ranch bridge site multiple buttressing has resulted in over-widening of the channel at the crossing. These over-widened channels spread flow out across a much larger streambed. The downstream channels have higher width to depth ratios (reduced water depths), negatively affect the local aquatic habitat. Structural enhancement of the banks and adding bank full benches within the bridge's area of influence of the river channel will improve channel function locally (Rosgen 1998). Removal of road prisms within the flood plain would increase flood plain connectivity to the river channel and would reduce channel stress from concentration of flow during peak flow events.

The enhancement of vegetated edge overhead cover habitat would provide cover for fish when instream cover is less suitable. Overhead cover including undercut banks, overhanging vegetation, logs, and debris jams are typically important fish habitat in streams (Bjornn and

Reiser 1991). Efforts to restore affected bank edges, and addressing interrelated impacts of past peaking operations effects on downstream banks by enhancing width to depth ratios and restoring flood plain function, would increase quality and accessibility to overhead cover habitats.

Road treatments upland (decommissioning/closure/upgrade): Decommissioning, obliteration, and improvements to the upland road network is proposed under this alternative (see Matrix Roads and Access Alternative 3). Most actions are identified objectives as a means of improving watershed processes (wetland-meadow habitats), to maintain the proposed road network, and meet identified actions within the RMP. These proposed projects are not anticipated to directly affect the aquatic resources of the canyon (see Map 19a). Reduction in road densities in the canyon and improvement of drainage features for the road lengths potentially could indirectly cumulatively benefit the aquatic resources. Reductions in surface erosion from road networks, improved surface drainage of roads outside of draws, and increased infiltration of surface waters to subsurface layers would in turn potentially reduce additional water and road sediment from reaching aquatic habitat (Furniss et al 1991). Thus positively affecting peak flow patterns and sediment patterns in the river and fish bearing tributaries.

Cultural Resource Management - *Interpretive sites:* Interpretive sites are proposed for the cultural and historic resources of the canyon along Topsy Grade, and Beswick. See Recreation Resources affects analysis for impacts of interpretive site construction for impacts to aquatic resources.

Site protection actions: Actions to protect prehistoric cultural resource sites in the canyon are proposed under this alternative. Many of the protective measures would be conducted within the riparian reserves of the canyon. Most actions would include decommissioning or obliteration of roads currently leading to or through cultural sites, which would prevent further damage from vehicular access. Construction of fencing may also be incorporated so as to reduce/hinder access to cultural sites.

Decommissioning or, obliteration of roads and fence construction in riparian reserves is not expected to have a negative affect on aquatic resources, some beneficial impacts may occur by limiting/reducing vehicle use within the riparian reserves (see Road Closure discussion in Road Management affects analysis).

Vegetation Management - *Riparian vegetative treatments:* Proposed vegetation treatments (see Map 23) that increase the vegetative diversity, reduce fuel loading to reduce risk of catastrophic fire, and enhance riparian stands to accelerate CWD recruitment to stream channels, would have the greatest value to aquatic resources. A range of actions would occur under this alternative in the riparian reserves from mechanical and hand thinning, mechanical and hand piling, pile burning, and broadcast burning. In riparian reserves the individual proposed treatments would be designed to meet the Aquatic Conservation Strategies and would be reviewed for consistency with River Plan objectives and resource goals by the KFRA riparian team and the KFRA ID team.

Indirect impacts to aquatic habitats from riparian vegetation manipulation could result from actions proposed within this alternative. Removal or reduction in the riparian canopy could produce an increase in summer temperatures and a decrease in winter temperatures (Marcus et al 1990). Cumulative impacts to fishery resources of increased stream temperatures can include chronic stress and reduce fishery productivity from exposure to elevated sub-lethal temperatures. Larger streams, such as the mainstem river reaches in the planning area, would be more affected by removal of the taller vegetation within the riparian areas and less affected by understory treatments. In addition, reduced canopy cover can reduce inputs of organic debris and invertebrates from overhanging branches thereby reducing forage available to aquatic species.

Indirect effects of vegetative management may also occur as a result of using mechanical equipment in the riparian reserves. Road surfaces, landings, skid trails, ditches and disturbed areas can alter pathways water takes to stream channels, alter peak flows, and contribute sediment to stream channels (Chamberlin et al 1991). Changes in flow patterns and increased sediment transport would cause negative impacts to aquatic habitat and aquatic species.

Minimal harvesting and non-commercial treatments within the riparian reserves where CWD needs are met, and actions that maintain or contribute to moving stream channels toward PFC are not expected to have short-term negative impacts to the aquatic resources. Locating mechanical treatments outside the no-entry buffers, and following recommended PDF's, are anticipated to minimize compaction, soil displacement, and reduce surface erosion reaching the stream channel. Application of manual non-commercial treatments located within the no-entry buffer designed to control stocking, reestablish and manage stands and acquire desired vegetation characteristics to meet ACS objectives, are not expected to negatively affect the aquatic resource in the short-term. In the long-term restored and/or maintained riparian forest stand health would be anticipated to maintain, protect and restore aquatic resources. Alternative 3 proposes the most extensive vegetative treatments across the full planning area. The proposed actions would be expected to improve riparian habitat over existing conditions and reduce risk of catastrophic fire. This alternative would be expected to move riparian vegetative communities within the natural range of variation in the shortest time frame (see Map 23). This alternative would provide greatly accelerated rates of protection to vegetative communities, including riparian habitats, as compared to Alternatives 1, 2 and 4.

Upland vegetative treatments: Proposed upland actions would primarily revolve around thinning and fuel reduction treatments. Upland vegetation treatments would not be expected to directly impact the aquatic resources. Indirect negative impacts from heavy use of the Planning Area road network may occur, resulting in elevated sediment production (Chamberlin et al 1991). Increased sediment transmission from road surfaces to stream drainages may occur during the first wet season after treatments, and would reduce as vegetative recovery occurs (Furniss et al 1991). Implementation of this alternative with the application of the identified mitigation and appropriate BMP's and the described PDF's are expected to minimize short-term impacts to aquatic resources.

Terrestrial Species/Habitat Management - No negative impacts to aquatic resources from proposed non-vegetation based wildlife projects would be anticipated under this alternative. Some beneficial impacts to aquatic resources may be realized by maintaining wildlife based road closures. See road management sections for impacts to aquatic resources of proposed and ongoing road management for Alternative 3.

Watershed Management Actions - *Water quality/beneficial uses:* Alterations in water releases from the hydroelectric facilities would be pursued in order to eliminate water quality impairment as a result of power operations annual and daily alteration of the hydrograph. Changes in water release patterns from both the powerhouse and dam would be pursued to reduce temperature gradients. Stream temperatures, which are in part determined by instream flow releases from project dams, are known to strongly influence trout growth (Stillwater 1999). Factors limiting the growth of older trout are not known, but both temperature and food likely affect growth rates. Reduction in daily fluctuations in temperature would be expected to beneficially affect aquatic species. Biological factors potentially affected include aquatic habitat, migration, disease resistance, metabolic efficiency, and competition (Hicks et al 1991). Specific fish response may vary depending on species and location in the river.

Negative impacts of altering flows to minimize temperature fluctuation may include increased duration of chronic stress from exposure of fish species to consistently higher water temperatures. Refugial habitats from tributary inflow, such as Shovel Creek, may become more important during certain times of the year. The proposed instream enhancements, increased pool depths and reduced width to depth ratios, would result in increased habitat

complexity which may offset some impacts of exposure to chronic temperature regimes (Poole et al 2001).

River flows: Alterations to instream flow would be pursued in order to enhance aquatic and riparian resources. Enhancement of flows under this alternative would assume restoration to unaltered flow from J.C. Boyle dam. This would result in substantial increases in base flow during critical summer months both in the bypass reach and below the powerhouse. Stream flows that increase accessibility to overhead cover including undercut banks, overhanging vegetation, logs, and wood jams would enhance fish habitat (Bjorn and Riser 1991). Implementation of the recommended unimpaired run of the river flow patterns, in tandem with restored sediment regimes would foster vegetative growth along the bank and aid toward narrowing the active channel widths, thus improving overhead cover habitat. Stabilizing flows would be expected to result in greater primary production and macro-invertebrate production thus resulting in increased food sources for native fish species (Stillwater 2000).

Artificial ramping/peaking operations below the powerhouse and high percentages of the river being bypassed from segment one would be eliminated. Diurnal fluctuation in water temperature would end, temperature gradients would be eliminated or reduced as a result of unimpaired flows in the bypass reach. The negative impact to the aquatic resources from such temperature shifts would largely be eliminated. Negative impacts to fisheries from unimpaired flow may include elevation of base temperatures beyond the range preferred for rearing, inhibition of upstream migration of adults, increased susceptibility to disease, reduced metabolic efficiency, and shifts in competitive advantage (Hicks et al 1991).

Conflicts that exist between flows most suitable for recreational rafting and aquatic resources would be resolved in favor of aquatic species. Efforts should be made to determine the optimum flows for all native species of fish that would exist in the canyon. These flows should address the critical link between connectivity to habitat resources both upstream and downstream of the planning area for the fish species present.

Riparian function: See discussion of riparian vegetation treatments for affects to aquatic resources.

Aquatic Species/Habitat Management - *Sediment management:* Restoration of coarse sediment that has been captured by the project facilities (Link River dam to J.C. Boyle Dam) and is no longer supplied to the river in the planning area would occur under this alternative. Treatment would enhance instream projects, bank development, and provide additional spawning habitat for native species (trout). The deposition/distribution pattern of additional gravel would largely be based on stream gradient and morphology (Rosgen 1996). In steeper gradient stretches little gravel deposition would be expected to occur, where channel velocities are high. In lower gradient stretches, such as the Frain Ranch area and below Stateline, substantial changes in point bar deposition patterns would be expected to occur. Sediment enhancements would aid in recovery of riparian vegetation by providing rooting areas for riparian species such as willow, alder, cottonwood, sedges, reeds and rushes. Enhanced/recovered riparian vegetation would increase bank strength due to deeper/higher strength root masses and potentially result in bank building (Platts 1991, Marcus et al 1990). Increased riparian vegetation along the river edge would trap fine sediments and contribute to reductions of embeddedness of the larger sediment particles in channel. Bank building may result in narrowing the river channel and improving the width to depth ratio. Bank vegetation and discharge from bank water storage, hyporheic flows, would enhance water quality (Poole and Berman 2002), thus providing additional edge aquatic habitats along much of the length of the river.

Without some degree of sediment regime recovery most other actions proposed to enhance aquatic habitat; including alteration in flow regimes, bankfull bench installation, cutoff

treatments, and channel width treatments would not be expected to substantially contribute to aquatic habitat recovery/enhancement.

Instream structures (wood/rock, side channel/chute cutoff treatments, bridge sites, and width treatments): Treating locations with wide channel widths and shallow depths would be anticipated to improve local aquatic habitat (see Map 27). Narrow single thread channels would enhance instream cover to aquatic species and reduce risks of stranding. Cross sectional morphology of stream channels influences the likelihood of stranding (Stillwater 1999). Channels with an abundance of shallow habitat are more likely to have larger areas exposed during down ramping where fish could become separated from the main river flow due to declines in stage.

Proposed channel structures include one or multiple wing deflectors, "j"-hook type structures, or "w" type channel structures (Rosgen 2001). These structures would aid in formation of mid-channel pools by increasing local shear stress to the existing riverbed and would act as sediment storage areas upstream of the structure. Combined with restoration of sediment regimes these structures would then also potentially create spawning habitat for native fish species.

Some treatments in the mainstem channel could incorporate coarse woody debris (CWD). Most treatment with wood in the mainstem would be placement of the wood along the riparian bank edge. In larger stream types, increases in coarse woody debris would "cap" side channels, and cause scour pools (Murphy and Meehan 1991). Increases in CWD that contribute to logjams in the planning area would enhance secondary channels and off-channel sloughs and marshes, effectively increasing habitat complexity and total rearing area. Assuming restoration of sediment is implemented, sediment deposition potentially may occur upstream or downstream of the log depending on it's position in the channel.

The proposed tributary CWD enhancements would be expected to enhance channel morphology, increase retention of organic matter and provide essential aquatic habitat (Murphy and Meehan 1991). Sediment deposition associated with CWD can lead to formation of terraces, thus increasing the size of riparian areas (O'Connel et al 2000). Increased habitat complexity and enhanced riparian vegetative cover would be expected to improve water quality in tributaries such as Hayden Creek or the mouth of Edge Creek, and improve aquatic habitat of resident fish in these systems.

Treatment of side channel/chute cutoffs to limit high flows in these secondary channels would reduce the risk of fish stranding, particularly during hydropower peaking operations. Limiting flow in these cutoffs would concentrate main channel flow, resulting in increased channel velocities in the primary channel. The desired channel response would include increased channel depth and reduced width to depth ratios. The total area of aquatic habitat available for occupancy would be reduced, however the quality and diversity of habitat would be increased.

The proposed treatment of side channels and rerouting the stream channel without a thorough understanding of the site-specific process that formed the channel features may result in negative impacts on channel function (Rosgen 1988). Potential site-specific processes that would need addressing including meander geometry related to stream to size, stream features such as riffle/pool sequences, and hydraulic geometry relationships in order to protect the channel function. Taking into account channel functions and implementing the proposed river width adjustments, proposed augmentation of sediment (gravel), and proposed instream flows with the treatment of these side channels would be expected to protect and enhance the channel and result in enhanced aquatic habitat diversity.

Long-term beneficial impacts to aquatic resources would be expected from all proposed instream structures, which would enhance channel function, increased hyporheic connectivity,

and increase instream habitat complexity. Enhancement of the tributary stream Shovel Creek would increase quality and quantity of aquatic habitat on up to two miles of important fish bearing water in Segment 3.

Bypass Canal side cast actions: Removal of the sidecast, resulting from the hydro-power canal and road construction, on historic floodplains and within the river channel would alter aquatic habitats along approximately 1.25 miles of river. Excavation and removal of sidecast material would be down to historic flood prone elevations. Excavation to historic flood prone elevation should be at or near the average bankfull flow return interval. Reaching this elevation is critical in order to restore lateral connectivity and hydrologic function (Rosgen 1998). Restoring the 1.25 miles of the rivers edge impaired by side cast boulder debris would provide some bank stability and minimal area for riparian vegetation recovery. Restoration of flood prone terraces with a coordinated transplanting of willow would be expected to increase the overhanging vegetation along the streams edge. Increasing overhead cover habitat would be partially contingent on a sediment replenishment program to provide necessary materials to establish and enhance the bankfull terraces for developing new riparian vegetation (O'Connel et al 2000). In combination, these actions would provide cover habitat for fish species that otherwise doesn't exist in Segment 1. Additional food sources for aquatic species would also become available from overhanging vegetation through organic matter falling to the river waters, such as leaves, insects, and detritus (O'Connel et al 2000).

Irrigation diversion treatments (mainstem and tributary): All irrigation diversions impairing channel function of the Klamath River in the Planning area would be recommended for removal in the long term. This action would involve incremental implementation in order to protect/restore meadow habitat in the short term. Removal of diversions and installing bankfull benches would protect and enhance the river hydrologic function (Rosgen 1998). Installation of these benches with coordinated riparian vegetative transplanting would be expected to increase the overhanging vegetation along the streams edge. Increasing overhead cover habitat would be partially contingent on sediment deposition to provide necessary materials to establish and enhance the bankfull terraces for developing new riparian vegetation (O'Connel et al 2000). Additional food sources for aquatic species would also become available from overhanging vegetation through organic matter falling to the river waters, such as leaves, insects, and detritus.

Range Management - Livestock grazing can affect the riparian environment by reducing or changing vegetation, and eliminating riparian areas by channel widening, channel aggrading, or lowering of the water table (Platts 1991). Riparian zones are often grazed more heavily than upland zones because they have flatter terrain, water, shade, and succulent vegetation. Reduction in ground cover vegetation and increase in soil compaction associated with livestock use causes increased runoff (see water quality) and can negatively affect aquatic habitats. The recommended deferral of grazing action on all lands within the planning area would be expected to eliminate ongoing impacts to riparian and aquatic habitats and potentially achieve some degree of recovery within these affected habitats.

Fire and Fuels Management - Extensive use of prescribed fire would occur within the planning area to reduce fuel loads, and to improve plant and wildlife diversity. Most fuel management actions would occur in tandem with proposed vegetation enhancement or constitute a vegetation treatment. Impacts from these types of actions on aquatic resources are described in the Vegetation Management sections. Prescribed fires ignited outside the riparian reserves that are allowed to back into the riparian reserves are not expected to directly negatively affect the aquatic resources.

Contamination of riparian and aquatic habitat from use of volatile chemicals such as gasoline, kerosene, or diesel fuel may occur (as a result of leakage, spill, etc) during fuel management actions within riparian areas. These ignition chemicals have great potential for indirectly negatively affecting aquatic communities and salmonid habitats (Norris et al 1991). Implementation of the proposed actions with the application of the identified mitigation and

appropriate KFRA RMP BMP's and the described PDF's are expected to the minimize short-term risk of exposure to aquatic resources.

Land Tenure - Implementation of cooperative management agreements, land acquisition, and or land conservation easements would enable the BLM (and cooperators) to administer the lands within the Klamath river planning area to achieve landscape level resource objectives and maintain and enhance resource values. The ability of the BLM to improve aquatic habitats in the planning area would be expected to improve as ownership of the lands would allow a greater range of projects to be implemented as less administrative clearance would be needed to implement projects. Potential land tenure adjustments would eliminate the possibility of residential development of riparian lands within Segment 3. Management of PacifiCorp lands consistent with BLM goals and objectives would be anticipated to enhance and recover aquatic habitat though changes in land use and restoration of riparian habitats.

Hydropower Facilities - *Power production facilities:* Enhancement of flow releases from facilities associated with J.C. Boyle Dam would be pursued under this alternative. The proposed alteration in flow regimes at the powerhouse and changes in spill at the dam would reduce thermal gradients between the Segment 1 and Segment 2, and reduce temperature fluctuations in Segments 2 and 3.

Alteration of fish passage and augmentation of unscreened spill at the J.C. Boyle dam would also be pursued, and would be expected to improve fisheries connectivity between the planning area and upstream habitats. The configuration of the ladder including gradient and fish way entrance is not ideal, and attraction to the ladder is impaired (FishPro 2000). The proposed alteration of the fish passage facilities and attraction flow at J.C. Boyle Dam would be expected increase upstream movement of adult fish, currently occupying habitat in planning area reaches of the Klamath River, to important spawning, rearing, foraging areas in the upper river, including Spencer Creek. The proposed increase of unscreened spill from J.C. Boyle dam would enhance unobstructed downstream movement of juvenile salmonids and prey fish into the planning area.

Restoration of the eroded hill slope and floodplain below the emergency spillway would occur under this alternative by removing all of debris within the floodplain and river channel. Methods to stabilize and prevent further degradation of the site would also occur. Removal of debris on the flood plain would restore connectivity of the riparian areas and stream edge habitats. Channel function and riparian development would be expected to recover to the greatest extent under this alternative.

Transmission line rights-of-way: Extensive alteration of the power lines within the canyon is proposed under this alternative.

Option One - In general, burying power lines outside of riparian reserve's would have limited negative short-term impacts to aquatic habitats. Burial of power lines across drainages would result in exposed surfaces and potentially result in elevated risks of sediment transmissions reaching aquatic habitats (Furniss et al 1991). Construction during dry seasons and use of sediment reduction materials such as mulching would be expected to minimize this risk. Revegetation of exposed soils with native grasses, shrubs and trees would be expected reduce/ eliminate long-term sediment concerns.

Option Two - Removal of the low voltage power line system within the canyon would have minimal impact to the aquatic system. Short-term impacts may be occurring as a result of efforts to remove the power lines and the interrelated/interdependent impacts from the removal of road networks only necessary to access the power lines. See road decommissioning discussions in the Road and Access section for impacts of removal power line access roads.

Cumulative Impacts - Beneficial changes to the Klamath River geomorphology would be expected to occur under this alternative. River bank development would be expected to change due to the alteration of flow patterns, augmentation of coarse sediment in the system, and implementation of instream projects. Fish stranding would be expected to be reduced as side-channels, chute cutoffs and exposed point bars, which increase stranding risk, would be reduce or eliminated.

Depending of future operations of hydropower facilities, proposed actions would reduce the unbalanced longitudinal connectivity, the rates of downstream movement would be similar to upstream movement of fish and, in general, both migratory rates would be higher than under current regimes.

It would be expected that changes in temperature regimes, improvement in flow regimes, enhanced connectivity between the Keno Reach and the Planning area, changes in channel function, and increased reach habitat complexity would beneficially affect the native species. The proposed enhancement of the mainstem channel and tributaries would be expected to improve habitat quality for fry, juvenile, and adult trout. As habitat condition improves and connectivity improves longitudinally and laterally, the potential would exist for beneficially altering the relative abundance and size class distribution for native species. Ramping/ peaking in the planning area would not occur and impacts from that activity would end. The rate of recovery of instream and riparian habitat would be enhanced as a result of the cessation of artificial peaking.

This alternative has the greatest potential for achieving fisheries objectives in the Klamath River canyon. This alternative would provide greater beneficial effects to aquatic species and habitats than all other proposed alternatives.

Alternative 4

Scenery Management (Overlooks, River Corridors) - Limited vegetation management projects are proposed for scenic qualities. The actions proposed under other resources may affect scenic quality and thus scenery management may limit the scope of some projects within the canyon. No direct or indirect affects to aquatic resources are anticipated from scenery management actions proposed under this alternative.

Recreation Facilities and Management - The existing facilities within the riparian reserves disrupt natural habitat connectivity, limit vegetative community development at the site level, and indirectly affect the quality and quantity of habitat for aquatic and riparian dependant species. The degree of impact to the riparian system per site varies based on the size of the site and the level of use the site receives.

The proposed location for the Shovel Creek campground is near the riparian corridor of the Klamath River and Shovel Creek on PacifiCorp lands (see Map 16). The local vegetative community has substantially been altered from historic conditions; species present are predominately of pasture grass varieties with some riparian dependant vegetation occurring adjacent to the riverbank. To be consistent with NFP and RMP direction any new camping facility should be constructed outside these riparian corridors, sitting camp units and support facilities at least 280 feet from the Klamath River and Shovel Creek, or the camping facility should be specifically designed to maintain ACS objectives. Access to the river would be based on existing access point were feasible. Any additional access points should be designed so as to protect riparian vegetation and bank stability. Actions proposed that are beyond the extent of those impacts addressed here would need additional NEPA analysis.

Designated campsites without toilet facilities, or with improperly sited or designed facilities, could result in elevated releases of human waste contaminates to aquatic habitats (Clark and Gibbons 1991). The risk to fish may be through direct impact on the fish or indirectly on forage (Norris et al 1991). The additive impacts of Alternative 4 recreation actions on water

quality to the aquatic resources are uncertain. In order to prevent cumulative impacts to the aquatic biota, efforts should be made to minimize risks by following RMP BMP guidance on campsite location and providing restroom facilities when needed, based on site usage. Human use may also have indirect impacts to aquatic resources due to firewood collection, reducing riparian CWD and thus indirectly affecting recruitment of CWD to stream channels.

Construction of a raft launch facility at J.C. Boyle dam would be expected to impact aquatic systems by disrupting the natural connectivity of aquatic habitat to the riparian community, limiting development of riparian vegetation, and creating routes for sediment to reach the river (see Map 16).

Construction/hardening of new parking areas along the bypass canal road are proposed under this alternative in order to provide public access to the bypass reach channel for fishing. Indirect impacts to aquatic resources from impacts to riparian reserves would not be expected to occur as parking locations are proposed on previously disturbed sidecast and fill slopes of the road, no riparian vegetation would be affected. Potential increases in sediment reaching the stream channel may occur as a result of increased use of road surfaces (Chamberlin et al 1991).

Several interpretive sites (J.C. Boyle Dam fish ladder, J.C. Boyle Powerhouse, Spring Island, and Frain Ranch) are proposed within the riparian reserves under this alternative. J.C. Boyle Powerhouse has massively altered the riparian habitat and reduced quality of aquatic habitats. No additional impacts to aquatic species or habitats would be expected from the interpretive site.

Construction of interpretive facilities at J.C. Boyle dam may affect the recovering of the vegetative community at the site. A non-hardened (native surface) parking area is adjacent to the dam access road. Use of this area for parking and creating a trail on the existing native surface road leading to the base of the dam would be expected to have the least impact on the riparian community and thus minimal impact to aquatic habitat.

Additions of interpretive sites at Spring Island and Frain Ranch are not anticipated to have additive impacts to aquatic resources over the existing condition and other proposed actions at these locations.

Three miles of existing designated trails would be maintained under this alternative. In addition, just under three miles of existing road would be converted to trails. Within the planning area most trail lengths are located in the riparian reserves of the Klamath River. The existing Turtle Camp Trail is not directly adjacent to stream edges and has only limited impacts to the aquatic resources. In locations where the trail crosses drainages, use and maintenance of the trail may locally increase sediment reaching stream channels (Furniss et al 1991). Implementation of best management practices pertaining to trail maintenance would be expected to limit impacts to aquatic habitats.

Over 18 miles of new trails would be constructed within the riparian reserves of the planning area under this alternative (see Map 16 and Table 5-9). Five of those miles of new trails are proposed to be constructed on and immediately adjacent to recently exposed flood prone areas within Segment 1 under this alternative. Exposed surfaces (non-vegetated and/or hardened) associated with trails would be at risk to erosion during the wet season (Furniss et al 1991). In addition, these exposed surfaces would be at greater risk to substantial degradation under channel forming flows that reach trail surfaces. Any sidecast from trail construction within the bypass reach that falls to the river may directly affect aquatic habitat. Efforts should be made to minimize debris reaching river channels. The proposed bypass reach trail when located adjacent to the river channel or on the flood area would be anticipated to affect riparian vegetation and potentially aquatic habitats. Implementation of PDF's, including locating trails properly, and enhancement of riparian and uplands vegetation between the trail and river edge would limit the impacts to aquatic habitats.

Trail construction and maintenance typically includes cutting/bucking downed woody debris in order to provide unobstructed routes for human use. Bucking of logs that may reach to the river channel would be expected to reduce the value of these as CWD in for creating and improving aquatic habitats. Larger wood would be expected to resist high flows and alter local channel morphology by creating scour pool and sediment depositional areas. Both these channel features are beneficial to aquatic habitat. Implementing trial maintenance PDF's would protect riparian and aquatic CWD source material.

Flows that enhance recreational rafting and recreational fishing would be pursued under this alternative. See Watershed Process discussion for impacts of varying flows on aquatic resources.

Minimal impacts to the aquatic ecosystem would be anticipated as a result of the proposed upland recreation project under this alternative. Some impact to canyon drainages may result from upland OHV trails running through ephemeral channels, meadows, seeps and springs. This type of disturbance may result in development of source areas for sediment transmission to aquatic habitats, particularly during wet periods (Furniss et al 1991).

Road Management - *Road treatments within riparian reserves (improvement/ decommissioning/closure):* Approximately 11 miles of road would be affected within the riparian reserves under this alternative (Tables 5-10a and b and 5-11a and b). Actions would be conducted in order to maintain or enhance existing road networks or to maintain and enhance ACS objectives (see Map 20a). The majority of road miles treated in the riparian reserves would be contiguous treatments, decommissioning or seasonal closures (see road treatment table). Some roads proposed for obliteration would be converted from the vehicular access roads to non-motorized hiking trails.

Short term impacts from road decommissioning could include increased erosion during the first wet season from loosened soils (Furniss et al 1991). Erosion of exposed and ripped road surfaces potentially could reach stream channels. Fine sediment particles in the river and fish bearing streams of the Canyon would impair aquatic habitat recovery, increasing sediment embeddedness, reducing subsurface percolating flows. Surface erosion would be expected to abate over time through natural revegetation.

Reduction in road densities in the riparian corridors of the planning area and improvement of drainage features for the remaining road lengths potentially could provide indirect long-term benefits to the aquatic resources. Road networks can accelerate peak flows in small watersheds due to road network increasing the effective drainage network of a watershed (Marcus et al 1990). Reductions in road density through decommissioning would reduce exposed surface area for potential surface erosion, improve surface drainage of roads outside of draws, and increase infiltration of water to subsurface layers, thus reducing ditchline runoff and the potential transport of sediment to riparian and aquatic habitat (Furniss et al 1991, Chamberlin et al 1991). Overall road densities in the riparian areas would be expected to decrease somewhat under this alternative, thus positively affecting peak flow patterns and sediment patterns in the river and fish bearing tributaries.

The proposed installation of administrative and seasonal use closures (see Map 20b) of unsurfaced and low use roads within the planning area would protect these road surfaces from use during the wet season thus reducing the potential and extent of surface erosion reaching stream channels (Furniss et al 1991).

The proposed improvement of planning area roads would be expected to reduce sediment production from these road surfaces (Furniss et al 1991). This would in turn improve local water quality in tributary streams that may be affected by these treatments. Localized benefits to aquatic species would occur by reducing sediment loads to aquatic habitats. Mainstem

water quality is not likely to be substantively affected due the small percentage of road treatment proposed under this alternative and the extent of watershed upstream of the planning area.

Stream crossing upgrades within riparian reserves: The proposed stream crossing upgrades under this alternative would be expected to have short-term negative indirect impacts to aquatic habitat and aquatic species. Actions would be limited to dry season operations so no aquatic species would be present during construction. Construction actions within the streambed would disturb stream substrate, and potentially increase erosion by loosening riparian soils and stream banks (Furniss et al 1991). Increased sediment potentially would reduce habitat quality during the first wet season after construction. Long-term enhancement of aquatic habitat would be expected as stream substrate, banks, and riparian habitats re-vegetate and stabilize. Improved stream crossings would provide enhanced aquatic species access to upstream habitats and would be expected to reduce road surface erosion from reaching stream channels.

Bridge treatments and upgrades (Rock Creek, Upper Frain, Lower Frain, Stateline): Upper Frain Ranch and Stateline bridge sites have created flow constrictions, increasing water velocities and subsequently altering channel features, such as width to depth ratio and sediment transport (Rosgen 1996). The downstream channels have higher width to depth ratios (reduced water surface depths), which negatively affect the local aquatic habitat. Structural enhancement of the banks and adding bank full benches within the bridges influence of the river channel will improve channel function locally. Increasing span length, or designing bridge abutments to be isolated during high flows would aid in hydrologic function at the site. Increases in flood plain connectivity to the river channel would reduce channel stress from concentration of flow during peak flow events.

Peaking operations make edge habitat only available for short periods of time during low flow periods. Overhead cover including undercut banks, overhanging vegetation, logs, and debris jams are typically important fish habitat in streams (Bjornn and Reiser 1991). Fish within the degraded reaches are limited in accessing these overhead cover habitat types. Efforts to design bridge sites with lowered width to depth ratios and flood plain function would reduce impacts of peaking flows on aquatic species by increasing accessibility of overhead cover habitats.

Improving the lower Frain Ranch Bridge site would aid in narrowing the active channel width both above and below the site. Reducing the width to depth ratio at this location would increase water depth and provide more available habitat during low flow periods.

Redesign of Rock Creek bridge and the stream channel would occur under this alternative. Fish species do not occupy Rock Creek reaches affected by the proposed bridge and channel enhancements. Proposed improvements to route water through the bridge, rather than down the road bed, would be expected to improve aquatic habitat downstream by reducing sediment transmissions. However, short-term (first wet season) negative effects to aquatic habitat downstream of the bridge site may occur from sediment transport, as a result of in stream work.

J.C. Boyle Dam Bridge would be replaced with a modern vehicle load bearing bridge. The existing bridge currently is condemned for vehicular use. Reconstruction of this bridge would likely increase fine sediment production during construction and first wet season after (Furniss et al 1991), particularly due to footing excavation and installation. The bridge additionally constricts channel width, locally creating a pool downstream of the bridge. The withdrawal of water from the site, for power production, has reduced the extent of potential impacts of the bridge location. Changes of instream flow in segment 1, as a result of fisheries flows, may have additional impacts without design accounting for potential flow ranges. Design of a new bridge at this site should account for changes in instream flow. The log stringer bridge is made up of asphalt treated wood members that may impact water quality if

material is not moved away from the channel after construction. Removal of these timbers from the river is recommended to prevent wood preservatives from contaminating aquatic habitats.

Road treatments upland (decommissioning/closure/upgrade): Extensive improvements of the upland road network are proposed under this alternative (see Appendix H Roads and Access Alternative 4). Most actions are identified as a means of improving watershed processes, to maintain the existing road network, and meet identified objectives within the RMP. These proposed projects are not anticipated to directly affect the aquatic resources of the canyon (see Map 20a). Road networks can accelerate peak flows in small watersheds due to road network increasing the effective drainage network of a watershed (Marcus et al 1990). Reductions road density through decommissioning would reduce exposed surface area for potential surface erosion, improve surface drainage of roads outside of draws, and increase infiltration of water to subsurface layers, thus reducing ditchline runoff and the potential transport of sediment to riparian and aquatic habitat (Furniss et al 1991, Chamberlin et al 1991).

Cultural and Historical Resources and Traditional Use Areas - *Interpretive sites:* Interpretive sites are proposed for the cultural and historic resources of the canyon along Topsy Grade, and Beswick. See Recreation Resources section for impacts of interpretive site construction for impacts to aquatic resources.

Site protection actions: Actions to protect prehistoric cultural resource sites within the riparian reserves of the canyon include capping of sites with surfacing materials such as crushed gravel, boulders, and/or dirt fill. Placement of these materials near or adjacent to the river channel could result in a short term increase in fine particulates reaching aquatic habitat. As vegetative recovery takes place and the initial washing of surface sediment occurs the extent of this impact would be minimal.

Proposed fencing actions would not be expected to directly affect aquatic habitat. Fencing actions proposed to protect cultural sites may have an indirect beneficial affect on riparian resources and aquatic habitat by reducing human use impacts within these protected areas.

Vegetative Management - (Includes actions for fuels, wildlife habitat, silviculture and weed control.)

Riparian vegetative treatments: Proposed vegetation treatments that would increase the vegetative diversity, reduce fuel loading to reduce risk of catastrophic fire, and enhance riparian stands to accelerate CWD recruitment to stream channels, would have the greatest value to aquatic resources (see Map 24). A range of actions would occur under this alternative in the riparian reserves from mechanical and hand thinning, mechanical and hand piling, pile burning, and broadcast burning. In riparian reserves the individual proposed treatments would be designed to meet the Aquatic Conservation Strategy Objectives and would be reviewed for consistency with River Plan objectives and resource goals by the KFRA riparian team and the KFRA ID team.

Indirect impacts to aquatic habitats from riparian vegetation manipulation could result from actions proposed within this alternative. Removal or reduction in the riparian canopy could produce an increase in summer temperatures and a decrease in winter temperatures (Marcus et al 1990). Cumulative impacts to fishery resources of increased stream temperatures can include chronic stress and reduce fishery productivity from exposure to elevated sub-lethal temperatures. Larger streams, such as the mainstem river reaches in the planning area, would be more affected by removal of the taller vegetation within the riparian areas and less affected by understory treatments. In addition, reduced canopy cover can reduce inputs of organic debris and invertebrates from overhanging branches thereby reducing forage available to aquatic species.

Indirect effects of vegetative management may also occur as a result of using mechanical

equipment in the riparian reserves. Road surfaces, landings, skid trails, ditches and disturbed areas can alter pathways water takes to stream channels, alter peak flows, and contribute sediment to stream channels (Chamberlin et al 1991). Changes in flow patterns and increased sediment transport would cause negative impacts to aquatic habitat and aquatic species.

Minimal harvesting and non-commercial treatments within the riparian reserves where CWD needs are met, and actions that maintain or contribute to moving streams toward a functional condition are not expected to have short-term negative impacts to the aquatic resources. Locating mechanical treatments outside the no-entry buffers, and following recommended PDF's, are anticipated to minimize compaction, soil displacement, and reduce surface erosion reaching the stream channel. Application of manual non-commercial treatments located within the no-entry buffer designed to control stocking, reestablish and manage stands and acquire desired vegetation characteristics to meet ACS objectives, are not expected to negatively affect the aquatic resource in the short-term. In the long-term restored and/or maintained riparian forest stand health would be anticipated to maintain, protect and restore aquatic resources. Proposed treatments would be expected to improve riparian habitat over existing conditions and reduce risk of catastrophic fire similar to actions proposed under Alternative 2, however the extent of protection would be less than Alternative 3.

Upland vegetative treatments: Proposed upland actions would primarily revolve around thinning and fuel reduction treatments. Upland vegetation treatments would not be expected to directly impact the aquatic resources (see Map 24). Indirect negative impacts from heavy use of the planning area road network may occur, resulting in elevated sediment production (Chamberlin et al 1991). Increased sediment transmission from road surfaces to stream drainages may occur during the first wet season after treatments, and would reduce as vegetative recovery occurs (Furniss et al 1991). Implementation of this alternative with the application of the identified mitigation and appropriate KFRA RMP BMP's and the described PDF's are expected to minimize short-term impacts to aquatic resources.

Terrestrial Species/Habitat Management - See consequences discussion of vegetation management for proposed wildlife projects addressing the canyons vegetative community.

No negative impacts to aquatic resources from proposed non-vegetation based wildlife projects would be anticipated under this alternative. Some beneficial impacts to aquatic resources may be realized by maintaining wildlife based road closures. See road management sections for impacts to aquatic resources of proposed and ongoing road management for Alternative 4.

Watershed Management - *Water quality/beneficial uses:* Daily fluctuation in water temperature of up to 12 degrees Fahrenheit may continue, assuming the river flows are peaked to benefit summer rafting opportunities. The impact to the aquatic resources from such temperature shifts would also be expected to continue. Some beneficial impacts to aquatic habitat may occur as a result of increased base flows in the bypass reach, including reduced thermal gradient at the springs and at the confluence with the full flow reach

River flows and water rights: Alterations to instream flow would be pursued in order to enhance recreational resources (rafting and fishing). Enhancement of flows under this alternative would assume an increase in base flow during critical summer months both in the bypass reach and below the powerhouse. Stream flows that increase accessibility to overhead cover including undercut banks, overhanging vegetation, logs, and wood jams would enhance fish habitat (Bjorn and Riser 1991).

Continuation of ramping/peaking operations below the powerhouse and diversion of high percentages of the river from Segment 1 would maintain much of the existing degraded aquatic conditions and species distributions. Diurnal fluctuation in water temperature would continue, but the overall gradient would be reduced as a result of increased base flow in the bypass reach. The negative long-term impact to the aquatic resources from such temperature

shifts would be reduced in extent. However, impacts to fisheries may include elevation of temperatures beyond the range preferred for rearing, inhibition of upstream migration of adults, increased susceptibility to disease, reduced metabolic efficiency, and shifts in competitive advantage (Hicks et al 1991).

Conflicts exist between optimal flows for recreational rafting and aquatic resources. Efforts to maintain suitable of daily/seasonal rafting opportunities may come into direct conflict with beneficial flow for aquatic species. The proposed peak flows, for rafting opportunities in Segment 2 and 3, would limited recovery and enhancement of riparian vegetative and maintain widened channels (Marcus et al 1990). The lack of available riparian vegetation would continue to affect the aquatic species in the planning area. Risk of fish stranding on point bars and side channels that are currently being dewatered during peaking operations would also continue.

Riparian function: See discussion of riparian vegetation treatments for affects to aquatic resources.

Aquatic Species/Habitat Management - *Fisheries flows (including temperature):* Alteration in flow regimes will be pursued under this option to optimize flow for recreation values. See Watershed Process discussion for impacts of varying flows in aquatic resources.

Sediment management: Spot sediment enhancement would be implemented to replace sediment that has been captured by the project facilities (Link River dam to J.C. Boyle Dam) and are no longer available to the river channel. Treatment sites would be located to enhance/ stabilize instream projects and provide additional spawning habitat for native species (trout). The deposition/distribution pattern of additional gravel would largely be based on stream gradient and morphology (Rosgen 1996). In steeper gradient stretches little gravel deposition would be expected to occur, where channel velocities are high. In lower gradient stretches such as the Frain Ranch area and below the State line substantial changes in point bar deposition patterns could occur with sufficient sediment augmentation. Sediment enhancements would aid in recovery of riparian vegetation by providing rooting areas for riparian species such as willow, alder, cottonwood, sedges, reeds and rushes.

Enhanced and recovered riparian vegetation would increase bank strength due to deeper/ higher strength root masses and potentially result in bank building (Platts 1991, Marcus et al 1990). Increased riparian vegetation along the river edge would trap fine sediments and contribute to reductions of embeddedness of the larger sediment particles in channel. Bank building may result in narrowing the river channel and improving the width to depth ratio. Bank vegetation and discharge from bank water storage, and hyporheic flows, would enhance water quality (Poole and Berman 2002), thus providing additional edge aquatic habitats along much of the length of the river during temperature limiting periods in the summer. The nature of sediment enhancements, associated with the proposed instream projects, would be expected to provide limited instream aquatic habitats when compared to Alternatives 2 and 3 as the sediment supplies, instream flow, and channel processes necessary for recovery would limited in availability.

Instream structures (wood/rock, side channel/chute cutoff treatments, bridge sites, and width treatments): Proposed treatment locations with extreme channel widths and shallow depths would be anticipated to improve local aquatic habitat (see Map 28). Narrow single thread channels would enhance instream cover to aquatic species and reduce risks of stranding. Cross sectional morphology of stream channels influences the likelihood of stranding (Stillwater 1999). Channels with an abundance of shallow habitat are more likely to have larger areas exposed during down ramping where fish could become separated from the main river flow due to declines in stage.

Proposed channel structures include one or multiple, wing deflectors, “j”-hook type structures, or “w” type channel structures (Rosgen 2001). These structures would aid in

formation of mid-channel pools by increasing local shear stress to the existing riverbed and would act as sediment storage areas upstream of the structure. Combined with sediment enhancement, at these structures would also potentially create spawning habitat for native fish species.

Some treatments in the mainstem channel could incorporate coarse woody debris. Most treatment with wood in the mainstem would be placement of the wood along the riparian bank edge. In larger stream types, increases in coarse woody debris would "cap" side channels, and cause scour pools (Murphy and Meehan 1991). Increases in CWD that contribute to logjams in the planning area would enhance secondary channels and off channel sloughs and marshes, effectively increasing habitat complexity and total rearing area. Assuming a sediment augmentation program is implemented, sediment deposition potentially may occur upstream or downstream of the log depending on it's angle of repose in the channel.

The proposed tributary CWD enhancements would be expected to enhance channel morphology, increase retention of organic matter and provide essential aquatic habitat (Murphy and Meehan 1991). Sediment deposition associated with CWD can lead to formation of terraces, thus increasing the size of riparian areas (O'Connel et al 2000). Increased habitat complexity and enhanced riparian vegetative cover would be expected to improve water quality in tributaries such as Hayden Creek or the mouth of Edge Creek, and improve aquatic habitat of resident fish in these systems. Due to conflicts with recreational rafting goals (wood material in the mainstem river channel should not obstruct safe passage) the dynamic function of large wood in the system would be reduced. Wood that obstructs safe rafting passage would be bucked or in some other fashion removed in the mainstem of the river. To prevent CWD transport to mainstem water, tributary structural enhancements would be designed to retain wood at or near original placement locations. Installation potentially would cause short-term disturbance to stream banks. Bank edges and flood prone areas may be disturbed (by anchoring the log ends), in order to increase retention of wood at project sites.

Treatment of side channel/chute cutoffs to limit high flows in these secondary channels would reduce the risk of fish stranding, particularly during hydropower peaking operations. Limiting flow in these cutoffs would concentrate main channel flow, resulting in increased channel velocities in the primary channel. The desired channel response would include increased channel depth and reduced width to depth ratios. The total area of aquatic habitat available for occupancy would be reduced, however the quality and diversity of habitat would be increased.

The proposed treatment of side channels and rerouting the stream channel without a thorough understanding of the site-specific process that formed the channel features may result in negative impact on channel function (Rosgen 1988). Potential site-specific processes would need addressing including meander geometry related to stream size, stream features such as riffle/pool sequences, and hydraulic geometry relationships in order to protect the channel function. Taking into account channel functions and implementing the proposed river width adjustments, proposed augmentation of sediment (gravel), and proposed instream flows with the treatment of these side channels would be expected to protect and enhance the channel and result in enhanced aquatic habitat diversity.

Some long-term beneficial impacts to aquatic resources would be expected from the proposed instream structures, which would enhance channel function, increase hyporheic connectivity, and increase instream habitat complexity. This alternative provides fewer beneficial effects to aquatic resources, when compared to instream treatments in Alternatives 2 and 3.

Bypass canal sidecast actions: Sidecast material in the bypass reach (Segment 1) that is limiting to fish passage during low flows would be removed. Implementation of this action would increase accessibility to the upper mile of the bypass reach during base flow conditions (see Map 28). Direct and indirect impacts to aquatic resources would be expected during the

instream working period due to the use of heavy equipment. Some degree on passage recovery would be expected.

Irrigation diversion treatments (mainstem and tributary): Structural enhancements recommended for irrigation diversions with high width to depth ratios would occur under this alternative. Treatments would improve the width to depth ratios to enhance channel function and would be expected to improve aquatic habitat. Proper design of diversions can lead to development of pools downstream of the diversion, which also function as aquatic habitat (Rosgen 2001). This action combined with sediment enhancement would also be expected to enhance spawning habitat, the structures would function as catchments for gravel-sized bedload.

Livestock Grazing - The proposed grazing actions on BLM, and those recommended on PacifiCorp lands would be expected to maintain or slightly improve conditions on riparian and aquatic habitats. Application of range management recommendations on PacifiCorp lands would result in reducing AUM's from existing levels. Increased monitoring of grazing utilization and application of adaptive management would be expected to reduce to extent of impacts.

Fire and Fuels Management - Extensive use of prescribed fire would occur within the planning area to reduce fuel loads, and to improve plant and wildlife diversity. Most fuel management actions would occur in tandem with proposed vegetation enhancement or constitute a Vegetation Management treatment. Impacts from these types of actions on aquatic resources are described in the vegetation management sections. Prescribed fires ignited outside the riparian reserves that are allowed to back into the riparian reserves are not expected to directly negatively affect the aquatic resources.

Contamination of riparian and aquatic habitat from use of volatile chemicals such as gasoline, kerosene, or diesel fuel may occur (as a result of leakage, spill, etc) during fuel management actions within riparian areas. These ignition chemicals have great potential for indirectly negatively affecting aquatic communities and salmonid habitats (Norris et al 1991). The risk to aquatic habitat from use of ignition fuels can be greatly reduced with the proper buffer distances from streams. Implementation of the proposed actions with the application of the identified mitigation and appropriate KFRA RMP BMP's and the described PDF's are expected to the minimize short-term risk of exposure to aquatic resources.

Land Tenure - Implementation of cooperative management agreements, land acquisition, and or land conservation easements would enable the BLM (and cooperators) to administer the lands within the Klamath River planning area to achieve landscape level resource objectives and maintain and enhance resource values. The ability of the BLM to improve aquatic habitats in the planning area would be expected to improve if ownership of the lands was consistent. BLM management would allow a greater range of projects to be implemented with less administrative coordination.. Potential land tenure adjustments would limit the extent of residential development of riparian lands within Segment 3. Management of PacifiCorp lands consistent with BLM goals and objectives would be anticipated to enhance and recover aquatic habitat though changes in land use and restoration of riparian habitats.

Hydropower Facilities - *Power production facilities:* Enhancement of flow releases from facilities associated with J.C. Boyle Dam would be pursued under this alternative. The proposed alteration in flow regimes at the powerhouse and changes in spill at the dam would reduce thermal gradients between the Segments 1 and 2, and reduce temperature fluctuations in Segment 2 and 3.

Alteration of fish passage facilities and augmentation of unscreened spill at the J.C. Boyle dam would also be pursued, and would be expected to improve fisheries connectivity between the planning area and upstream habitats. The configuration of the ladder, including gradient and fishway entrance, is not ideal, and attraction to the ladder is impaired (FishPro 2000).

The proposed enhancement of the fish ladder and attraction flow at J.C. Boyle Dam would be expected to increase upstream movement of adult fish. The fish currently occupying habitat in planning area reaches of the Klamath River, could migrate to important spawning, rearing, foraging areas in the upper river, and tributaries including Spencer Creek. The proposed increase of unscreened spill from J.C. Boyle dam would enhance unobstructed downstream movement of juvenile salmonids and prey fish into the planning area.

Stabilization of the emergency spillway and implementation of structural controls would likely prevent further degradation of the upper bench and hill slope leading to the river channel. Actions to improve the riparian and channel function impaired spillway, including installation of bankfull benches in the boulder debris on the historic flood plain and removal of boulder debris in channel, would improve aquatic habitats. Channel function and riparian development would be expected to experience some degree of recovery under this alternative.

Transmission line rights-of-way: Alterations to the power lines within the canyon proposed to enhance the wildlife resources, would require minimal ground disturbing actions. The power line system within the canyon is having minimal to no impact to the aquatic system. Indirect impacts may be occurring as a result of the power company's efforts to maintain the power lines and the interrelated/interdependent impacts to maintain the road network to service the lines. Surface erosion from roadbed surfaces, drainage ditches, and cut and fill surfaces can increase movement of fine sediment to streams below the right of way (Furniss et al 1991).

Maintaining this additional road network in the canyon could result in long-term negative effects on aquatic resources. Erosion of fine sediment to the river channel can result in increased substrate embeddedness and a reduction in aquatic habitat quality for incubation, rearing and forage.

Cumulative Effects - Minimal changes to the Klamath River geomorphology would be expected to occur under this alternative. Due to the limited extent of proposed alteration of flow patterns, augmentation of sediment in the system, and implementation of instream projects the river bank development would not be expected to change. Reductions in fish stranding risks may occur in targeted side channels, chute cutoffs and point bars but the limited nature of proposed instream projects would not reduce the risk across the planning area.

Depending of future operations of hydropower facilities with this alternative, proposed actions would reduce the unbalanced longitudinal connectivity, and the rates of downstream movement would be similar to upstream movement of fish. In general both migratory rates would be higher than under current regimes.

Enhanced thermal gradients, improvement base flow, and enhanced connectivity between the Keno Reach and the Planning area would beneficially affect the native species. The proposed enhancement of the tributaries and to a lesser extent the mainstem channels would be expected to improve habitat quality for fry, juvenile, adult trout.

As habitat conditions improve and connectivity improves longitudinally and laterally, the potential would exist for beneficially altering the relative abundance and size class distribution for native species. However, the continuation of ramping/peaking in the planning area would be expected to continue to limit lateral connectivity, thus, reducing the duration of access, to cover habitats for forage species and fish in the fry and juvenile life stages.

This alternative would have the fewest beneficial effects on aquatic species and habitats than the other action Alternatives, 2 and 3, primarily due to continued peaking for rafting, and the limited nature of flow regime, sediment regime, and structural enhancements proposed. This alternative would still provide increased aquatic benefits over the no-action alternative.

Irretrievable, Irreversible, and Unavoidable Adverse Impacts

No known Irretrievable, Irreversible are expected to occur to aquatic habitats. Short-term unavoidable adverse impacts such as the release of fine sediments and increased turbidity would occur during and shortly after construction of in stream structures and with restoration activities near the shoreline.

Range Resources

Assumptions/Impacts Common to All Alternatives

Effects on or to livestock grazing under this plan would result primarily from changes in the amount of forage available and/or allocated to livestock grazing and the exclusion of areas from grazing due to other higher resource priorities. Aside from the current situation (Alternative 1), the grazing use proposed in this plan is predicated on the management objectives and restoration projects generated by the other resource programs; impacts to livestock grazing are directly related to these other resource objectives and projects. Consult these other sections for specifics, including the impacts of grazing on these other resources.

The four Alternatives could be lumped into two functionally distinct options: those that essentially prohibit grazing (Alternative 3); and those that call for only slight variations from the current grazing use (Alternatives 2 & 4). Alternative 1 would not change current operations or direction. The differences between Alternatives 1,2, and 4, are significantly less than the difference between these Alternatives and Alternative 3. In general, the primary impacts to livestock grazing are that under Alternatives 2 & 4 the grazing use will be at levels the same as to slightly less than that currently made; in Alternative 3, regular grazing use would be eliminated. Management actions that exclude livestock (e.g. fencing) from range that is currently available would have a negative effect roughly proportional to the amount of land excluded. The exclusion of high production areas (e.g. riparian) would, of course, have a disproportionately negative effect in reducing forage quantity and/or quality. Conversely, vegetation treatments or enhancements (e.g. fuels reduction, oak thinning, road revegetation, etc.) that increase the amounts of herbaceous plants available and/or improve overall ecological conditions, could conceivably benefit livestock by providing better quantity and/or quality of forage resources.

One potential range improvement project is common to all of the alternatives. It is the construction of up to 2 miles of additional fencing along the north Klamath River Canyon rim to inhibit livestock movement into and out of the canyon. Currently, there is approximately 2 miles of fencing along the rim, which inhibits but does not totally restrict livestock movement. As additional cattle trailing “holes” are found, they may be fenced as necessary - a process that has already been going on for some years. The result of the additional fencing will be less need for grazing use supervision due to less unauthorized use - a positive impact. And finally, the impacts from cultural resource related projects is minor to nonexistent under all the Alternatives, except where areas may be exclusion fenced (similar to the riparian areas noted above).

Impacts of Specific Alternatives

(Refer to Map 8, and Appendix H)

Alternative 1

Under this alternative, there would be no significant change in the levels of grazing use on public or private lands. Thus, there would be no significant additional impacts or effects beyond those analyzed in the September 1994 Klamath Falls RMP/EIS for livestock grazing (pages 4-135 through 4-137), or in the case of the Laubacher Lease allotment (see Map 8) in California, as described in the Redding R.A. RMP/EIS. The continuation of the present levels of livestock grazing would be a direct and variably positive economic effect to the planning area, as compared to the reductions envisioned under the other three alternatives.

Cumulative Impacts - Same as that comprehensively analyzed in the above plans; consult for details.

Alternative 2

The primary direct impact under this alternative is the significant reduction in livestock grazing by deferring all or part of the grazing use on the private lands for some years until certain resource objectives are achieved (as discussed in other sections). The grazing use deferrals would be dependent on the specific project work being performed at a given time and the project specific requirements for grazing deferral. The loss of up to several thousand AUMs of grazing capacity/use off the private lands is a relatively significant loss to the planning areas overall grazing utility and in the short-term (up to 5-10 years), to the agricultural portion of the areas economy. Even with the potential for restoring some/most of the private land grazing use in the future, the capacity of the livestock operation that has been in the canyon for many years, will still likely be substantially diminished. (However, since these are private lands, the actual scope and duration of the reductions in livestock use cannot be precisely ascertained and are not directly within BLM control.)

There will be some minor reductions in the total grazing area available on the public lands under this alternative, dependent on the actual amount of land exclusion fenced to accomplish resource objectives noted in other sections. These losses are not expected to be significant since only small portions of the public lands in the canyon are grazed currently. Additionally, the Edge Creek allotment (see Map 8) includes grazing areas above the rim (Ward Pasture - which is outside this area of analysis) that provide enough forage to still allow for the full leased grazing use to take place, making the in-canyon impacts negligible (though this area is not preferred by the current grazing lessee due to rough terrain and access problems). The proposed reduction in the roads available in the analysis area may slightly inhibit the ability of the grazing user(s) to access livestock, though this likely a minor concern. An indirect effect of the road reductions would be an increased possibility of unauthorized use (i.e. grazing outside the season of use) if the grazing user is less able to find and gather animals.

Cumulative Impacts - The potential reductions in grazing use in the analysis area (public and private) may add to the reductions that are likely due to the recent designation of the Cascade-Siskiyou National Monument, which lies directly to the north and west of the analysis area. The grazing lessee in this planning area is also partially dependent on grazing lands in the Monument. The cumulative effect of two special designations - and related reductions in grazing use over time - would in combination be a significant impact to the operator's economic viability. Though it is not possible to precisely quantify this impact at this time, it is likely that the livestock operations would not be commercially viable and may cease.

Alternative 3

The primary direct impact under this alternative is the significant reduction in livestock grazing occurring within the planning area by permanently eliminating all use - public and private. The permanent loss of several thousand AUMs of grazing capacity/use on the private (and some public) lands is a significant reduction in the areas grazing utility and agricultural economy. Enhanced environmental conditions due to grazing exclusion - including better water quality - may lead to increased recreation opportunities and use, which could make up all or a portion of the economic loss. (Note: As noted earlier, the actual scope and duration of the reductions in livestock use on the private lands can not be precisely determined and is not directly within BLM control.)

Though no grazing use would be authorized on the public lands in the analysis area, the grazing areas above the rim (and outside the planning area) have ample enough forage to still allow for the full leased grazing use to take place on the Edge Creek allotment (see Map 8). Prohibiting grazing in the planning area would slightly decrease the overall administrative workload for the BLM, though this could be offset by the need for additional field checks to ensure that unauthorized use does not occur. Additional forage for wildlife - particularly elk that have a high dietary overlap with cattle - would potentially be available under this alternative, though forage is not known to be currently limiting to any of the wild herbivores. Conversely, an indirect impact of no livestock grazing could be an increased danger of wildfire due to a build up of additional fine fuels.

Cumulative Impacts - See Alternative 2, since the cumulative impacts under this Alternative would be similar, though more amplified due to the total prohibition of livestock. In fact, impacts under this Alternative may be enough to render the current livestock operation uneconomical. However, the removal of all livestock from the analysis area, in hand with the restoration activities proposed in other resource sections, could lead to the better ecological condition of some of the degraded vegetation communities - particularly in the riparian/meadow areas and upland areas with a high amount of undesirable exotic plant species. This could lead to a higher esthetic profile for the area, which may attract more visitors and offset some of the economic losses (see other sections, particularly recreation and fisheries).

Alternative 4

Implementation of this alternative would result in direct impacts that would be a mix between Alternatives 1 & 2. Fencing of new or existing recreation areas would directly limit livestock access and forage, as described previously. Recreation facilities or environmental enhancements that draw additional people to the analysis area, may disturb (harass) livestock grazing activities slightly, though this would probably not be significant. Similarly, increased livestock presence related complaints (noise, smell, dung) would be inevitable with more people visiting the area and would result in more BLM administrative attention. The possible increase in the roads available in the analysis area may slightly increase the ability of the grazing lessee to access his livestock, though this is very minor (though potentially positive) effect.

Cumulative Impacts - Same as the cumulative impacts listed for Alternative 2.

Irretrievable, Irreversible, and Unavoidable Impacts

The continuance of high grazing levels on the private lands could result in irretrievable (though unquantifiable) soil loss and commensurate deterioration in the ecological conditions/potential of the riparian/meadow vegetation communities. (See other resource sections of this chapter for more information.) The permanent exclusion of important areas from livestock grazing for resource protection reasons - which is already currently allowable under the above

two RMP/EIS's and the "Northwest Forest Plan" - would result in the permanent loss of forage for livestock and possibly small economic losses to the area.

For Alternative 3, the impacts to the livestock operation from the grazing elimination on private lands may be enough to unavoidably put the current lessee out of business. The loss of several thousand AUMs of grazing use may be an irreversible economic impact to the analysis area, though could be replaced in whole/part by increased recreation expenditures. The small loss of grazing on the public lands under this Alternative would be a minor impact, which in itself would not be enough to significantly impact the current operation.

Wild Horses

Assumptions/Impacts Common to All Alternatives

A very small percentage (<5%) of the Pokegama Herd Management Area (HMA) is located within the planning area (see Map 8). Therefore, impacts to the HMA, habitat, and overall herd management will be very limited or negligible under all the alternatives. (There is no impact on the Gavin Peak Herd Management Area, which is immediately adjacent to, but outside of the planning area; hence, it will be considered no further.) The wild horses only sporadically use the portions of the HMA that are inside the planning area. For example, they may occasionally be found on the south facing slopes of the canyon during the early spring when the green-up of the plentiful annual grasses is a highly attractive forage source. Also, the horses may be found in the bottom of the canyon during either high snowfall years (too much snow on top of the rim for easy access) or during significant drought years (like 2001) when water and green feed is restricted outside the canyon itself.

Although a mix of impacts/effects are noted in the following narrative, none of them could be considered anything more than insignificant impacts to the wild horse herd. One direct impact that is common to all the alternatives is that with the continued presence of wild horses in the area, domestic/wild horse interaction conflicts will invariably continue. These interactions are typically wild stud horses desiring to add domestic mares to their harem bands (or start a band), which results in damage to fences and other private property and occasionally, even the loss of a domestic horse.

Impacts of Specific Alternatives

(Refer to Map 8 and Appendix H)

Alternative 1

Impacts would be largely as analyzed in the September 1994 Klamath Falls RMP/EIS for wild horses (pages 4-137 through 4-139). One direct impact could be that a continuation of full livestock grazing in the planning area could conceivably reduce the amount of forage available for wild horses, compared to the other alternatives, since the forage preference overlap between cattle and horses is almost complete. However, forage quantity is not known to be an issue currently in the planning area portion of the HMA, with the possible exception of drought years. Even then, wild horses have a high capacity to range far in search of forage and water if pressed to do so. The current moderate levels of fencing in the area probably inhibit wild horse movement to a small amount, but not significantly. Continued cattle grazing on the public and particularly private lands, may lead to deteriorated ecological conditions of riparian and/or upland vegetation communities, leading to somewhat poorer habitat for wild horses.

Cumulative Impacts - No cumulative effects beyond that analyzed in the KFRA RMP/EIS are expected.

Alternative 2

Impacts to wild horses would be largely similar to that in Alternative 1, though the more that livestock are limited for other resource reasons, the more potential forage could potentially be available for horses. Exclusionary fencing would limit the habitat/forage and water available for wild horses like it would for livestock. Habitat improvements for wildlife species could improve the same for wild horses by improving ecological conditions and forage quantity. A reduction in the number of roads in the area could be a positive impact to the wild horses by lessening human disturbance. Improved riparian/wetland conditions could provide enhanced wild horse habitat characteristics, though if fenced the benefits may not be realized.

Cumulative Impacts - Insignificant cumulative impacts would occur to the wild horse herd since the planning area is an insignificant portion of the HMA.

Alternative 3

As this is the only alternative that totally precludes cattle use, it would provide the potential maximum amount of additional forage for wild horses. However, since the planning area does not comprise a significant portion of the HMA, this alternative still has an insignificant effect on the wild horse herd. Without livestock grazing in the planning area, much of the fencing in the canyon may be removed. This would enhance the potential for the wild horses to expand their available habitat somewhat - possibly into the private meadow lands along the river that they are largely excluded from now. Less fencing would mean more water available for the wild horses to use. Improved riparian/wetland conditions could provide enhanced wild horse habitat characteristics, though if these were to be fenced, horses would be excluded from the benefits. A higher level of road density reductions would be a positive effect by limiting the potential for detrimental human disturbance.

Cumulative Impacts - Insignificant cumulative impacts would occur to the wild horse herd since the planning area is an insignificant portion of the HMA.

Alternative 4

Additional recreational facilities, and the added human disturbances this would entail, could be a slight negative impact to the wild horses, though the Pokegama horses have not shown a tendency to be particularly shy of humans. Fencing around the additional facilities could limit wild horse access somewhat and possibly restrict some watering areas. Decreases in livestock numbers for recreation enhancement reasons would have impacts similar to those discussed for the other 3 alternatives. However, like with the other alternatives, the overall potential impacts to the horse herd are insignificant.

Cumulative Impacts - Insignificant cumulative impacts would occur to the wild horse herd since the planning area is an insignificant portion of the HMA.

Irretrievable, Irreversible, and Unavoidable Impacts

The permanent exclusion of areas via fencing could have the irreversible effect of reducing the available forage base for horses. This type of protection is currently allowable under the KFRA RMP/ROD.

Also see Range Resources section.

Fire and Fuels

Impacts Common to All Alternatives

Prescribed fire, and wildfire, short of catastrophic levels, would generally improve habitat conditions by diversifying habitat structure, providing short-term improvement in forage palatability, and increasing the availability of herbaceous forage plants. Some habitat changes would result in adverse impacts to species reliant on large homogeneous blocks of vegetation types. Most vegetation types are dependent on fire return intervals that have been modified over the last century. Returning these habitats to historic fire interval levels, or management close to these levels, would generally increase the quality of habitat. Extreme wildfire that causes mortality in existing plants and soil sterilization can lead to noxious weed infestation, and may demand immediate attention for rehabilitation efforts.

Impacts of Specific Alternatives

(Refer to Maps 5, 21-24, and Appendix H)

Alternatives 1 through 4

Each alternative will reduce fuel loading within the project area. Specific acreages of treatment can be found under the Vegetation management section. In general Alternative 3 treats more area so it reduces the fuel loading more and moves the area toward historic fire interval levels more quickly.

Air Quality

Impacts Common to All Alternatives

All the alternatives propose to use prescribed fire so consequently all alternatives would emit varying amounts of particulate matter. Because of the ability to manage emissions from prescribed fire (through timing burns with projected weather patterns), the air quality goal should be met. Wildland fire is a random event and smoke and particular matter cannot be managed. The alternatives with larger amounts of fuel treatments in the short-term, should have lesser impact on air resources from wildfires in the long-term. Due to the relative isolation of the area and the predominant wind patterns for smoke dispersion, the probability is low to degrade any key airsheds. These local impacts would be transitory in nature and no long-term smoke impacts are expected.

The Clean Air Act requires each state to develop and implement a State Implementation Plan (SIP) to ensure that National Ambient Air Quality Standards are attained and maintained for particulate matter (PM10). The focus of the analysis of effects on air quality from prescribed burning is on the production of PM10 (Particulate Matter smaller than 10 microns). To obtain some indication of how future burning within the river corridor may impact emission reduction goals, the estimated emissions of each alternative will be estimated in the final EIS. It is expected that prescribed burning proposed for the river corridor would not compromise the ability to reach and maintain prescribed burning reduction goals under any of the proposed alternatives. Under all proposed alternatives, prescribed burning would comply with the

guidelines established by the Oregon Smoke Management Plan (OSMP) and the Visibility Protection Plan. Prescribed burning under all alternatives is not expected to affect visibility within nearby smoke sensitive Class I areas (Mountain Lakes) during the visibility protection period (July 1 to September 15). Prescribed burning is not routinely conducted during this period primarily due to the risk of an escape wildfire.

Prescribed burning emissions, under all alternatives, are not expected to adversely effect annual PM10 attainment within Klamath Falls, or the Medford non-attainment area. Any smoke intrusions into these areas from prescribed burning are anticipated to be light and of short duration. Prescribed burning would be scheduled primarily during the period starting in October and ending in June. Handpile burning would also be planned during the fall, winter and spring months to reduce damage to the site from high intensity burning and to facilitate control of the units being burned. Current avoidance strategies for prescribed fire assume that smoke can be lifted from the project site and dispersed and diluted by transport winds. Smoke retained on site could be transported into portions of non-attainment areas if it is not dispersed and diluted by anticipated weather conditions. Localized concentration of smoke in rural areas in northern California may occur.

Impacts of Specific Alternatives

(Refer to Maps 5, 21 thru 24, and Appendix H)

Alternatives 1 through 4

Specific analysis of the effects of alternative will be determined in the smoke management plan. Data is currently unavailable to complete this analysis.

Land Tenure

Assumptions/Impacts Common to All Alternatives

The Klamath Falls Resource Area RMP identifies approximately 2,250 acres of private land within the planning area that is suitable for acquisition. The Record of Decision for the Klamath Falls RMP (June 1995) placed public lands within the planning area in land tenure Zone 1. Public lands in Zone 1 have important resource values and will remain in public ownership. Zone 1 lands are not available for disposal by sale, exchange, or any other disposal method.

The private landowner is under no obligation to sell his/her privately owned lands to the BLM. This plan cannot and does not require a private landowner to sell his/her private lands to the BLM. The impacts described in this section will occur if and only if private land is sold to BLM.

Resource values on PacifiCorp lands were considered in all alternatives in this River Plan. PacifiCorp requested that approximately 6,000 acres of their private lands located within the planning area be considered in the plan for possible land tenure adjustments. PacifiCorp is considering several management options for these lands that are surplus to their needs for power production. PacifiCorp requested the BLM to consider their lands for exchange for other BLM lands, or purchase, or that BLM and PacifiCorp enter into a mutually beneficial land management arrangement of these lands.

If BLM acquired all of the private Oregon lands (2,249 acres of which 1,030 acres belongs to PacifiCorp) in the planning area, then Klamath County would lose approximately $2,000.00

annually in property tax revenues and the State of Oregon would lose approximately $59.00 in fire protection payments. These losses would be off set by money paid by BLM to Klamath County for deferred farm use taxes, if any, from the Payments in Lieu of Taxes Act (PILT) (32 U.S.C. 6901-6907) and money paid to the State of Oregon for fire protection. The amount paid under the PILT program will not equal the tax receipts. The BLM pays the State of Oregon approximately 56 cents per acre for fire protection on BLM administered lands located west of Highway 97. The State of Oregon, through Klamath County, collects $0.985/ acre for timberland and $0.397/ acre for grazing land for fire protection.

If acquired by BLM, important cultural, wildlife, recreational, visual and other resource values found on the private lands in Oregon would be protected and managed subject to staffing and funding limitations. If the mineral estate were acquired, mineral development would be prohibited, unless it could be made compatible with the protection and enhancement of the Outstandingly Remarkable Values of the Klamath River.

The BLM has acquired 1,657 acres since the 1993 Redding RMP was approved, and disposed of 16,928 acres during the same time period. This is more than a 10 to 1 ratio of increase of private lands due to BLM's actions. In addition, at least some of the lands proposed for acquisition within the Klamath River corridor were already considered in our cumulative analysis of impact to Siskiyou County in Appendix H of the 1993 RMP. In that document, a net increase of private land of 13,070 acres if BLM fully implemented the land tenure decisions of the RMP was predicted. The past disposal of nearly 17,000 acres within Siskiyou County by BLM far outweighs any potential expansion of the acquisition boundary being considered in the different alternatives (Berg 2002, Personal communication).

The land tenure impacts for Alternatives 2, 3, and 4 vary only in the amount of private land that is included within the proposed extended boundary of the Upper Klamath River Management Area (Redding RMP). The consideration to acquire land within this extended boundary of the Upper Klamath River Management Area in California (acreage depends on each alternative) applies only to PacifiCorp land.

Impacts of Specific Alternatives

(Refer to Maps 3, 9-12, and Appendix H)

Alternative 1

Land acquisition as described in the Redding RMP would be implemented under this alternative. In California, 2,290 acres of private land appear to be suitable for acquisition subject to the assumptions and limitations common to all alternatives. Administration of approximately 250 acres of Klamath National Forest land would eventually be transferred to the BLM (see Map 9).

If BLM acquired all the private lands within the existing project area boundary, grazing, motorized vehicle use and development would be managed or restricted on the acquired lands. Native vegetation would eventually return to the site and the overall condition of the site would improve. The cultural sites, wildlife, fisheries, scenery and the other outstandingly remarkable values within the project area boundary would be protected until the California River segment Congressional decision to designate to as a component of the Wild and Scenic River system.

Shovel creek and its clean cold waters, and the 4,379 acres of private land that forms part of the foreground and all of the background lands visible from the river would not be protected under this alternative and would be available for purchase by other individuals. Only State and local laws and regulations would restrict use and development of the land.

This alternative proposes the least amount of land acquisition and land tenure adjustments.

Cumulative Impacts - In addition to Oregon tax revenue losses, Siskiyou County would lose up to $4,200 in tax revenue. These losses would be off set by money paid by BLM to Siskiyou County from the Payments in Lieu of Taxes Act (PILT) (32 U.S.C. 6901-6907. The amount paid under the PILT program will not equal the tax receipts. The BLM pays the State of California for fire suppression costs but does not pay for fire protection.

Acquisition of the PacifiCorp land surrounding the Topsy road in California would not have any effect on its designation by Siskiyou County as a pubic road. Existing roads, such as the Hessig Creek road, that connect with the Topsy road and provide access to private lands would remain closed to the public. A right-of-way would be used to approve the year round use of a BLM administered road by an adjoining landowner unless the right of access was reserved by landowner the in the deed that conveyed the property to the United States.

Alternative 2

Under this alternative, proposals for land acquisitions occur in river Segments 1, 2 and 3. In Oregon, the proposed project area boundary would include PacifiCorp lands that would compliment the resource values found in river Segments 1 and 2. The possible acquisition of lands would affect about 900 acres of PacifiCorp lands.

In California, the proposed project area boundary expands to include Shovel creek and its watershed that is located within Township 48 North, Range 3 West, Mount Diablo Meridian . Outside of the Shovel Creek area, the boundary remains within one-quarter mile of the river. In this alternative an additional 2,119 acres could be acquired for a total of 4,409 acres (see Map10).

Shovel Creek and its contribution to the Klamath River of clean cold water and fish spawning habitat would be protected under this alternative. Cultural sites along the river and some of the lands that form the foreground and background visible from the river would also be protected. The lands not acquired would remain available for purchase. Use and development of those lands would only be subject to the limitations imposed by State and local laws and local planning regulations.

Cumulative Impacts - In addition to Oregon tax revenue losses, Siskiyou County would lose up to $7,900 in tax revenue. These loses would be off set by money paid by BLM to Siskiyou County from the Payments in Lieu of Taxes Act (PILT) (32 U.S.C. 6901-6907). The amount paid under the PILT program will not equal the tax receipts. The BLM pays the State of California for fire suppression on BLM administered lands.

Alternative 3

Under this alternative proposal, land acquisitions occur in river Segments 1, 2 and 3. In Oregon, the proposed project area boundary would include PacifiCorp lands that would compliment the resource values found in river Segments 1 and 2. The possible acquisition of lands would affect about 900 acres of PacifiCorp lands. These acquisitions would compliment the resource values found in the adjacent ACEC.

In this alternative the project area boundary is expanded easterly to include all the private land that is visible from any point along the upper Klamath River up stream from the tail waters of Copco Reservoir. This includes an additional 4,304 acres of private land for a total of 8,713 acres. An additional 300 Acres of Klamath National Forest land would be eventually transferred to the BLM for a total of 565 acres or managed for river values by the Klamath National Forest and 1,258 acres of BLM administered land that is identified for disposal would be included for a total of 1,478 acres (see Map11).

In addition to the resources protected under Alternatives 1 and 2, all the private lands that are visible from the portion of the Klamath River in the planning area would be protected from development and unrestricted use. Motorized vehicle use would be restricted to designated roads and trails and seasonal use restrictions to prevent resource damage would be implemented.

The 1,258 acres of public land currently identified for disposal in the Redding RMP would be retained in public ownership and would not be available for sale or exchange. This alternative proposes the greatest amount of land acquisition and land tenure adjustments. Under this alternative all roads that connect with the Topsy road could be acquired by BLM. Access to other private lands would be allowed with acquisition by BLM.

Cumulative Impacts - In addition to Oregon tax revenue losses, Siskiyou County would lose up to $18,500 in tax revenue. These losses would be off set by money paid by BLM to Siskiyou County from the Payments in Lieu of Taxes Act (PILT) (32 U.S.C. 6901-6907) and money paid to the State of California for fire protection. The amount paid under the PILT program will not equal the tax receipts.

Alternative 4

Under this alternative proposal, land acquisitions occur in river Segments 1, 2 and 3. In Oregon, the proposed project area boundary would include PacifiCorp lands that would compliment the resource values found in river Segments 1 and 2. The possible acquisition of lands would affect about 900 acres of PacifiCorp lands. These acquisitions would compliment the resource values found in the adjacent ACEC.

In California (river segment 3), the proposed project area boundary is mostly restricted to the BLM and PacifiCorp lands within Township 48 North, Range 3 West. Private lands proposed for acquisition comprise approximately 6,664 acres. Administration of approximately 250 acres of Klamath National Forest land would be transferred to the BLM (See map 12).

Impacts both positive and negative are similar to those in Alternatives 1 to 3 but cover slightly less area than Alternative 3. Some of the high background ridgelines, visible from the river, would not be protected under this alternative and would be available for sale and, if feasible, development.

Cumulative Impacts - In addition to Oregon tax revenue losses, Siskiyou County would lose up to $12,180 in tax revenue. These loses would be off set by money paid by BLM to Siskiyou County from the Payments in Lieu of Taxes Act (PILT) (32 U.S.C. 6901-6907). The amount paid under the PILT program will not equal the tax receipts. The BLM pays the State of California for fire suppression on BLM administered lands.

Irretrievable, Irreversible, and Unavoidable Impacts

If cooperative management partnerships or conservation easements or direct purchase with PacifiCorp do not occur in the future, then there is a strong likely hood that contiguous management of the resource values found in the Klamath River Canyon as identified in the ACEC evaluation and analysis would be greatly jeopardized. There is the possibility that PacifiCorp could sell their lands to another party who could possibly subdivide the lands, potentially disturbing the unique natural resources, which the areas possess. Land acquisition of private lands would ensure that these unique natural resources would continued to maintain or enhance through the land management practices proposed by the various alternatives.

Private Land

Assumptions

According to large-scale maps available to the BLM, it appears that the only private land owner that has land within the State Scenic Waterway is PacifiCorp. There may a few acres of other private land on the north side of the river above Big Bend that potentially is within the Waterway. Although it doesn't appear that this land is developable, it is possible that State Administrative Rules could apply to those lands.

Impacts Common to All Alternatives

Private land ownership (except for PacifiCorp land) within the planning area is not expected to change as a direct result of this plan. Private land owners would continue to have access to their lands even though some of the existing user-created or poor-condition roads could be closed or obliterated completely. Private landowners would benefit from decreased risk of wildfires occurring due to fuel reduction treatments proposed on BLM land and recommended on PacifiCorp land. Private landowners have the opportunity to have the BLM assist them with fuels reduction and timber stand health treatments through cooperative agreements. The views from private land may change slightly if treatment sites on BLM (and possibly PacifiCorp) are visible. Other evidence of management activities such as smoke from burning, or an increase in the number of vehicles on the roads may be undesirable to private landowners.

PacifiCorp allows public use of various sites on their lands for recreation purposes and even has agreements with the BLM and State of California for site development and management. Recreational uses are anticipated to increase to some degree under all alternatives. PacifiCorp has identified most all of these lands as "surplus to their needs for power generation", and therefore, could dispose of the lands. Continued use of these lands for recreation should not deter PacifiCorp from proceeding with any changes in land ownership or management of their lands (although changes could affect recreational users).

Impacts of Specific Alternatives

Alternative 1

No other specific impacts.

Alternative 2

The State of Oregon would implement a set of Administrative Rules for lands within the Scenic Waterway (Segment 2 in Oregon). Minimal, if any, impacts to private land within the Scenic Waterway from State Administrative Rule implementation would occur, because most land is owned by PacifiCorp, and is managed for "industrial" use.

Management Actions are proposed for PacifiCorp land but not other private land within the Planning Area. Actions on PacifiCorp lands are only made as recommendations. If recommendations are adopted, PacifiCorp would be affected mostly by recreation site development, road improvements and vegetation treatments.

Alternative 3

The State of Oregon would implement a set of Administrative Rules for lands within the Scenic Waterway (Segment 2 in Oregon). Minimal, if any, impacts to private land within the

Scenic Waterway from State Administrative Rule implementation would occur, because most land is owned by PacifiCorp, and is managed for "industrial" use.

Management Actions are proposed for PacifiCorp land but not other private land within the Planning Area. Actions on PacifiCorp lands are only made as recommendations. If recommendations are adopted, PacifiCorp affected mostly by eliminated grazing, irrigation changes, meadow management, road improvements and road closures, and vegetation treatments.

Alternative 4

The State of Oregon would implement a set of Administrative Rules for lands within the Scenic Waterway (Segment 2 in Oregon). Minimal, if any, impacts to private land within the Scenic Waterway from State Administrative Rule implementation would occur, because most land is owned by PacifiCorp, and is managed for "industrial" use.

Management Actions are proposed for PacifiCorp land but not other private land within the Planning Area. Actions on PacifiCorp lands are only made as recommendations. If recommendations are adopted, PacifiCorp affected mostly by recreation site development, reduced grazing, road improvements and road closures, and vegetation treatments.

Socioeconomics

Assumptions

Underlying trends of population growth, business cycles, and economic growth at the national, regional, and local levels would continue to be the primary determinates of local economic activity. Alternatives considered in this document do not influence national or regional trends. Alternatives considered in this document would have only a limited influence on the local economies of Jackson, Klamath, and Siskiyou Counties.

Impacts Common to All Alternatives

Recreational uses are anticipated to increase to some degree under all alternatives. Population growth in the area and the region is the principle cause of this underlying trend. The alternatives influence the relative attractiveness of the study area for recreation compared to other areas with similar recreational opportunities.

While decisions on this river plan/EIS can not directly affect the existence or operation of PacifiCorp facilities, it is possible that decisions could influence terms and conditions of PacifiCorp's next operating license. As such, there could ultimately be impacts on the economics of operating the facilities for PacifiCorp as a result of proposed management actions. However, the data necessary to make the estimates of financial impacts to PacifiCorp rely on propriety information. PacifiCorp is not in the position at this time to provide that information for the DEIS. The BLM recognizes that this could be valuable information to disclose in the DEIS, but acknowledges that it is not available at this time. We are hopeful that PacifiCorp will be able to provide such information through their comments on the DEIS or in coordination meetings with the BLM as we prepare the Final EIS.

Impacts of Specific Alternatives

Alternative 1

Employment - No changes in the existing local employment trends are anticipated under Alternative 1. Employment opportunities associated with grazing use, recreation and tourism, and federal contracting in the Upper Klamath River Wild and Scenic River and ACEC would continue. This employment is very small relative to the overall local economy. In addition, out of area commercial rafting, a primary commercial activity in the study area, generate employment outside the planning area.

Income - No changes in the existing local personal income trends are anticipated under Alternative 1. Income associated with grazing use, recreation and tourism, and federal contracting in the Upper Klamath River Wild and Scenic River and ACEC would continue. Employees and business owners receive income from these activities. This income is very small relative to the overall local economy. In addition, out of area commercial rafting operators generate income outside the planning area.

Agriculture - No changes in existing local agricultural trends is anticipated under Alternative 1. Existing agricultural uses on private lands (PacifiCorp) and permitted livestock use on public lands in the Upper Klamath River Wild and Scenic River and ACEC would continue. Income and employment would continue to vary annually subject to national and regional economic trends but would not be influenced by changes in federal management direction in the Upper Klamath River Wild and Scenic River or ACEC. The impacts of grazing use on federal lands would continue to be as described by the Klamath Falls Resource Area RMP/EIS and the Redding Resource Area RMP/EIS.

Lumber and Wood Products (1,100 acres of treatment) - This alternative would continue to provide limited opportunities for forest thinnings and commercial wood products. Most of the proposed treatment projects would be accomplished through contracts for fuels treatment and prescribed burning activities and would not result in commercially viable timber sales. These activities would continue to provide limited employment and income opportunities. The geographic distribution of these opportunities would depend the locations of successful contract bidders.

Recreation and Tourism - Recreation uses of all types are expected to increase under Alternative 1 at rates similar to existing trends. No actions would be implemented under this alternative that would increase the relative attractiveness of the area for recreation. Private and commercial whitewater boating opportunities would continue at current levels and existing use limitations accommodate anticipated growth. Motorized boating would not be prohibited so this potential future use would not be precluded.

Cumulative Impacts - No cumulative impacts to the local, regional, or national economies have been identified.

Alternative 2

Employment - No changes in the existing local employment trends are anticipated under Alternative 2. Employment associated with recreation and tourism, and grazing on public lands would continue. Opportunities associated with grazing use on private lands would be reduced in the short term and opportunities associated with federal contracting would increase. This employment is very small relative to the overall local economy. In addition, out of area commercial rafting operations generate employment outside the planning area.

Income - No changes in the existing local personal income trends are anticipated under Alternative 2. Income associated with recreation and tourism on public lands would continue.

Income associated with grazing use on public and private lands would be reduced and income associated with federal contracting would increase. This income is very small relative to the overall local economy. In addition, out of area commercial rafting operations generate income outside the planning area.

Agriculture - Reduction of grazing use on private lands (PacifiCorp) within the Klamath Canyon would negatively impact livestock production and sales for impacted operators during the duration of the deferral. Economically unviable livestock operations may result. The duration of impacts (short term or permanent) would be the result of private business decisions of the livestock operators. Permitted use levels on federal lands are not anticipated to change under this alternative. The impacts of grazing use on federal lands would continue to be as described by the Klamath Falls Resource Area KFRMP/EIS and the Redding Resource Area RMP/EIS.

Lumber and Wood Products (4,500 acres treated) - This alternative would provide expanded opportunities for forest thinnings and commercial wood products. Most of the proposed treatment projects would be accomplished through contracts for fuels treatment and prescribed burning activities and would not result in commercially viable timber sales and. These activities would provide increased employment and income opportunities. The geographic distribution of these opportunities would depend the locations of successful contract bidders.

Recreation and Tourism - Recreation uses of all types are expected to increase under this alternative relative to existing underlying trends. Actions would be taken under this alternative, which would generally increase the relative attractiveness of the area for developed, motorized and non-motorized recreation uses. Selected primitive use areas would be developed or have improved access, thus reducing the attractiveness of these areas for experiencing solitude. Non-motorized boating opportunities would become available in Segment l with increased flows from the J.C. Boyle Dam. Private and commercial boating opportunities would continue at the current level and use limitations accommodate anticipated future use levels. Motorized boating would be prohibited so this potential future use is precluded. Designated tour routes would enhance motorized opportunities.

Cumulative Impacts - Increased vegetation treatment activities would result in expanded contracting opportunities. The BLM and other agencies, including the Forest Service and State Forestry Departments are also increasing the emphasis on vegetative treatments for fuels reduction. This alternative contributes to the local economy by supporting the establishment of a stable, year-round industry to supply ecosystem restoration and vegetative treatment services. Additional cumulative impacts have been discussed under Range Resources.

Alternative 3

Employment - Limited reductions in the existing local employment trends are anticipated under Alternative 3. Employment associated with grazing on public lands and on private lands would be permanently reduced. Opportunities associated with recreation and tourism, especially whitewater rafting, would decrease. This employment is very small relative to the overall local economy. Opportunities associated with federal contracting would increase. In addition, reductions in commercial rafting would impact out of area operations that generate employment outside the planning area.

Income - Limited reductions in the existing local personal income trends are anticipated under Alternative 3. Income associated with grazing on public lands and private lands would be permanently reduced. Income associated with recreation and tourism, especially whitewater rafting, would decrease. Income associated with federal contracting would increase. This income is very small relative to the overall local economy. In addition, reductions in commercial rafting would impact out of area operations that generate income outside the planning area.

Agriculture - Permanent elimination of grazing use on private lands (PacifiCorp) within the Klamath Canyon would negatively impact livestock production and sales for impacted operators. Economically unviable livestock operations may result. The scope and type of impacts would be the result of private business decisions of the livestock operators. Permitted use levels on federal lands are not anticipated to change under this alternative. The impacts of grazing use on federal lands would continue to be as described by the Klamath Falls Resource Area KFRMP/EIS and the Redding Resource Area RMP/EIS.

Lumber and Wood Products (almost 7,000 acres treated) - This alternative provides the greatest opportunities for forest thinnings and commercial wood products. Most of the proposed treatment projects would be accomplished through contracts for fuels treatment and prescribed burning activities and would not result in commercially viable timber sales. These activities provide limited employment and income opportunities. The location of these opportunities would depend the locations of successful contract bidders.

Recreation and Tourism - Recreation uses of all types are expected to decrease under this alternative relative to existing underlying trends. However, an overall upward trend is still anticipated. Actions would be taken under this alternative, which would generally decrease the relative attractiveness of the area for developed, motorized and non-motorized recreation uses. Non-motorized boating opportunities would become available in Segment l with increased flows from the J.C. Boyle Dam. However, reduced peaking flows in the late summer would result in decreased private and commercial use at that time of the year. Reduction of this unique seasonal rafting opportunity would have a negative financial impact on existing commercial rafting permittees, many of whom extend their commercial season by traveling to the Upper Klamath River. Overall, annual use would remain about the same as current levels under this alternative. Motorized boating would be prohibited so this potential future use is precluded.

Cumulative Impacts - Increased vegetation treatment activities would result in expanded contracting opportunities. The BLM and other agencies, including the Forest Service and State Forestry Departments are also increasing the emphasis on vegetative treatments for fuels reduction. This alternative contributes to the local economy by supporting the establishment of a stable, year-round industry to supply ecosystem restoration and vegetative treatment services. Additional cumulative impacts have been discussed under Range Resources. A shorter available rafting season will eliminate a unique regional recreation resource. This will result in greater demand for access during the available season as use is concentrated. This could also alter use patterns on other rivers where commercial permittees on the Upper Klamath also run trips.

Alternative 4

Employment - Limited increases in the existing local employment trends are anticipated under Alternative 4. Employment opportunities associated with grazing use on public an private land (PacifiCorp) in the Klamath Canyon would continue. Employment opportunities associated with recreation and tourism, and federal contracting would increase. This employment is very small relative to the overall local economy. In addition, out of area commercial rafting operations generate employment outside the planning area.

Income - Limited increases in the existing local personal income trends are anticipated under Alternative 4. Income associated with grazing use in the Klamath River area would continue. Income associated with recreation and tourism, and federal contracting would increase. This income is very small relative to the overall local economy. In addition, out of area commercial rafting operations generate income outside the planning area.

Agriculture - No change in existing local trends. Existing agricultural uses on private lands (PacifiCorp) and permitted livestock use on public lands in the Klamath River area would continue. Income and employment would continue to vary annually subject to national and

regional economic trends but would not be influenced by changes in federal management direction. The impacts of federal land management would continue to be as described by the Klamath Falls Resource Area KFRMP/EIS and the Redding Resource Area.

Lumber and Wood Products (over 4,500 acres treated) - This alternative would provide expanded opportunities for forest thinnings and commercial wood products. Most of the proposed treatment projects would be accomplished through contracts for fuels treatment and prescribed burning activities and would not result in commercially viable timber sales. These activities would provide expanded employment and income opportunities. The geographic distribution of these opportunities would depend the locations of successful contract bidders.

Recreation and Tourism - Recreation uses of all types are expected to increase under this alternative relative to existing underlying trends. Numerous actions would be taken under this alternative, which would generally increase the relative attractiveness of the area for developed, motorized and non-motorized recreation uses. Selected primitive use areas would be developed or have improved access reducing the attractiveness of these areas to experience solitude. Extension of daily peaking flows and reduced ramp rates in the summer would result in increased private and commercial whitewater boating opportunities in Segments 2 and 3. Enhancement of this unique seasonal rafting opportunity would have a positive financial impact on existing commercial rafting industry as a whole. Existing individual permittees may experience additional competition. Motorized boating would be prohibited so this potential future use is precluded.

Cumulative Impacts - Increased vegetation treatment activities would result in expanded contracting opportunities. The BLM and other agencies, including the Forest Service and State Forestry Departments are also increasing the emphasis on vegetative treatments for fuels reduction. This alternative contributes to the local economy by supporting the establishment of a stable, year-round industry to supply ecosystem restoration and vegetative treatment services.

Irretrievable, Irreversible, and Unavoidable Impacts

No irretrievable, irreversible, or unavoidable impacts to the local, regional, or national economies have been identified.

Critical Elements of the Human Environment

There are no identified significant impacts to any of these elements. The alternatives include actions for varying degrees of resource use and protection. As a result, there are varying degrees of impacts, but none are significant. These critical elements will also be considered, as appropriate, in site-specific project design and implementation.

The critical elements of the human environment to be considered in this analysis include: air quality, floodplains, cultural/paleontological resources, prime or unique farmlands, Native American religious concerns, threatened or endangered species, areas of critical environmental concern, designated or potential wild and scenic rivers, wilderness or wilderness study areas, and whether any actions violate law. Also, based on Executive Branch Orders and US Department of Interior Policy or rulemaking additional factors must be assessed and include: unresolved conflicts, Environmental Justice, Indian Sacred sites, Indian Trust resources, Noxious and invasive weeds, and impacts on energy development.

Air Quality

Air quality is discussed in an earlier section.

Floodplains

Floodplains would potentially be impacted with each alternative. However, the overall impact would be positive due to actions to minimize vehicular traffic off roads and reduction of total road miles on floodplains. In addition, to some degree in Alternatives 2 and 4 and especially in Alternative 3, streambank restoration and changes in flows will help to stabilize and restore functionality of floodplains.

Cultural/Paleontological Resources

These are discussed in an earlier section.

Prime Or Unique Farmlands

No prime or unique farmlands occur on BLM lands in the planning area. Some irrigated pastures occur on PacifiCorp property but those are not mapped as prime or unique farmlands.

Native American Religious Concerns

These are discussed in an earlier section.

Threatened Or Endangered (T&E) Species

These are discussed in an earlier section.

Areas Of Critical Environmental Concern

There are no identified significant negative impacts to this element. However, in Alternatives 2 through 4 actions are proposed to enhance ACEC values that have been identified. In addition, in these same alternatives an expansion to this ACEC is proposed to include River Segment 1.

Designated Or Potential Wild And Scenic Rivers

There are no identified significant negative impacts to this element. In all alternatives Outstandingly Remarkable Values (ORVs) will be maintained. In Alternatives 2 through 4 actions are proposed to enhance the ORVs that have been identified.

Wilderness Or Wilderness Study Areas

There are no impacts to this element.

Do Any Actions Violate Law

Appendix C lists the various laws (legal authorities) that the BLM must adhere to in management of the river canyon. All actions are designed to meet these laws.

Unresolved Conflicts

Do any alternatives involve unresolved conflicts concerning alternative uses of available resources (NEPA section 102(2)(E)) not already decided in an approved land use plan? Some actions necessitate pre-disturbance surveys, or require that specific project design features or mitigation be implemented, but no unresolved conflicts occur with proposed actions. Actions

on privately owned lands and on Forest Service or State administered lands are only presented as recommendations.

Environmental Justice

Executive Order 12898 of February 11,1994 as amended by Executive Order 12948 provides that "each federal agency make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health and environmental effects of its programs, policies, and activities on minority populations and low-income populations." Environmental Justice "is achieved when everyone, regardless of race, culture, or income, enjoys the same degree of protection from environmental and health hazards and equal access to a healthy environment in which to live, work, and play " (Whorton and Sohocki 1996). Native Americans are a minority population of concern within the planning area because of historic and current uses of public lands for traditional cultural practices. The alternatives in this River Plan do not preclude collection of vegetative or natural products for personal use. No other ethnic groups or low income population have been identified as being disproportionately adversely impacted. The management actions in this proposed River Plan comply with Executive Order 12898 as amended and there will be no disproportionately high effects on minority, low-income populations or Indian Tribes as a result of the proposed management alternatives.

Alternative 1 maintains current levels of economic uses of the public lands. This includes economic activity associated with Federal grazing use, recreation, vegetation treatments and restoration.

Alternative 2 includes several actions to enhance visitor services and access on public lands. Economic activity associated with visitors to public lands would increase. Opportunities for both small firms and larger companies to bid on contracts for facility construction, vegetation treatments, and restoration projects would be increased.

Alternative 3 potentially decreases current levels of economic uses of the public lands but provides more opportunities for business contracting. This alternative includes several proposals to enhance visitor services and access on public lands, but changes in water delivery from PacifiCorp facilities may make whitewater rafting (especially with larger rafts) in late summer and fall infeasible. Economic activity associated with visitors to public lands could increase slightly because of general population increases, but BLM would not provide new facilities or opportunities to attract additional recreational users to the area. Alternative 3 decreases the level of economic opportunity due to decreased livestock use authorizations, and limited availability of special use permits. Opportunities for both small firms and larger companies to bid on contracts for vegetation treatments, and restoration projects would be increased substantially.

Alternative 4 includes numerous actions to enhance visitor services and access on public lands. Economic activity associated with visitors to public lands would increase including use by commercial rafting businesses. Opportunities for both small firms and larger companies to bid on contracts for facility construction would increase substantially, although, opportunities for contracts for vegetation treatments, and restoration projects would only increase marginally.

Use Of Indian Sacred Sites

Based on Executive Order 13007, there is a need to determine if there are impacts to use of Indian Sacred Sites. In general, actions proposed in alternatives do not restrict access to, or ceremonial use of, Indian sacred sites by Indian religious practitioners. However, some actions to reduce damage to cultural, watershed and aquatic resources include closure and decommissioning of some roads. Most of these roads are in areas where duplicate roads would remain for public use. While no actions would preclude access to and use of any sites,

the closure of roads could make it more difficult for some individuals to reach certain sites. In addition, there are no actions that would adversely affect the physical integrity of any known sacred sites and some actions are even proposed to stop ongoing degradation of sites. As mentioned above, the alternatives in this River Plan do not preclude collection of vegetative or natural products for personal use.

Indian Trust Resources

No Indian Trust Resources are identified in the planning area.

Noxious Weeds And Invasive Plant Species

No actions proposed would contribute directly to the introduction, existence, or spread of: Federally listed noxious weeds (Federal Noxious Weed Control Act); or invasive non-native species; Executive Order 13112 (Invasive Species). However, ground-disturbing activities could indirectly facilitate the introduction or spread of undesirable species. While this would not be a significant impact, specific actions to treat undesirable plant populations and project design features are proposed.

Adverse Energy Development Impacts

Do the alternatives have a direct or indirect adverse impact on energy development, production, supply, and/or distribution — Executive Order 13212 (actions to expedite energy-related projects)? Mineral energy sources are limited in the planning area, and opportunities to develop energy sources such as wind and solar are restricted due to topography. If sources were developable, road closures and decommissioning could lower, but would not restrict access.

Compliance with Existing Management Direction

Actions proposed in this EIS should comply with existing management direction. In some cases an action/effect would not comply unless some sort of mitigation was applied. In other cases, where mitigation would not solve the conflict, a specific Resource Management Plan amendment would be necessary. While a decision on the final EIS will in general, amend both Klamath Falls and Redding RMPs, it is important to identify potential changes here.

Recreation – With an increase in recreation developments and an accompanying increase in use with Alternative 4, it is unlikely that the semi-primitive motorized recreation opportunity spectrum (ROS) class would be achievable. Facility design standards are higher, and the potential number of daily visitor contacts would increase to where a “rural” ROS class would result. An amendment of the ROS class would be necessary if Alternative 4 was selected.

In Alternative 3, there is a possibility that changes in river flows would result in not being able to raft the river throughout the summer season. This may mean that the wild and scenic river recreational ORV (whitewater rafting) may not be maintained in as many as 50% of years. Instream channel restoration is proposed to reduce the width/depth ratio of the river (narrow and deepen the river channel) which could lead to more raftable flows in the mainstem of the river even during lower flows. If these treatments do not resolve the potential problem, then other mitigation would be needed to assure maintenance of the ORV.

Livestock Grazing - Removal of grazing from allotments in the Canyon under Alternative 3, would not be in compliance with the 1995 KFRA RMP/EIS...which authorized or reaffirmed existing levels of grazing (also acknowledged in the Topsy Pokegama Landscape Analysis).

An amendment of the authorized permitted grazing use would be necessary if Alternative 3 was selected.

Expansion of ACEC – Expansion of the Upper Klamath River ACEC from Segment 2 to Segment 1 in Oregon is proposed in Alternatives 2, 3, and 4. An ACEC evaluation identified important values in Segment 1 (see Map 2). In order to extend protection of values on this section of the Klamath River an amendment to the Klamath Falls Resource Area RMP would be needed.

Expansion of the Special Recreation Management Area – Based on the Redding RMP, land retention and disposal of land in Segment 3 is consistent between the Upper Klamath River Management Area and Alternative 1 (see Appendix D). For Alternatives 2, 3, and 4, land tenure adjustments (such as land acquisition and retention of BLM parcels identified to be disposed) are proposed outside the existing Upper Klamath River Management Area. An RMP amendment is proposed to expand the Upper Klamath River Management Area so that land tenure direction would be consistent throughout the entire project area for each alternative. The potential expansion would match the project area under each of the three alternatives.